R-4450.A

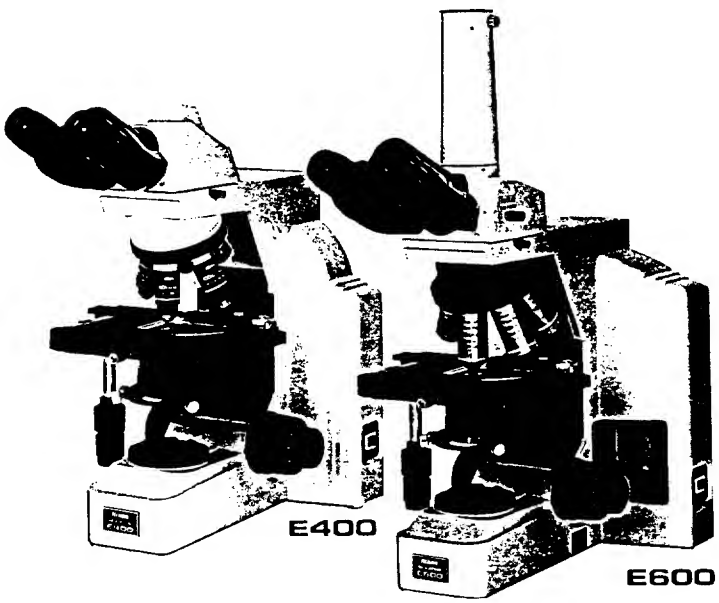
Nikon

MICROSCOPE

ECLIPSE E600/E400

修　理　指　針

REPAIR MANUAL



Nikon Corporation
株 式 会 社 ニ コ ン

INSTURUMENTS DIVISION
マイクロサイエンス事業部

Sep.'97.68

REV. RECORD

R-4450 | REV.NUMBER: 0

PAGE	REV.MARK	REV.DATE	PAGE	REV.MARK	REV.DATE	PAGE	REV.MARK	REV.DATE
1	A		41	A		81	A	
2	0		42	A		82	A	
3	A		43	A		83	A	
4	A		44	A		84	A	
5	A		45	A		85	A	
6	A		46	A		86	A	
7	A		47	A		87	A	
8	A		48	A		88	A	
9	A		49	A		89	A	
10	A		50	A		90	A	
11	A		51	A		91	A	
12	A		52	A		92	A	
13	A		53	A		93	A	
14	A		54	A		94	A	
15	A		55	A		95	A	
16	A		56	A		96	A	
17	A		57	A		97	A	
18	A		58	A		98	A	
19	A		59	A		99	A	
20	A		60	A		100	A	
21	A		61	A		101	A	
22	A		62	A		102	A	
23	A		63	A		103	A	
24	A		64	A		104	A	
25	A		65	A		105	A	
26	A		66	A		106	A	
27	A		67	A		107	A	
28	A		68	A		108	A	
29	A		69	A		109	A	
30	A		70	A		110	A	
31	A		71	A		111	A	
32	A		72	A		112	A	
33	A		73	A		113	A	
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35	A		75	A		115	A	
36	A		76	A		116	A	
37	A		77	A		117	A	
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1. PREFACE

◎ This repair manual applies to the following products:

- ○ MBA70XXX: E600 body
- ○ MBA80XXX: E400 body

- ○ MBB72100: Binocular Eyepiece Tube B
- ○ MBB73100: Trinocular Eyepiece Tube F
- ○ MBB73110: Trinocular Eyepiece Tube T
- ○ MBB76000: Binocular ergonomics Eyepiece Tube EX

◎ This repair manual is edited on the assumption that it is used as the textbook in the repair training courses. Trainees of the repair courses, who follow the steps described in this repair manual in sequence from the beginning to the end, would be able to understand the structure of the E600/E400 and be familiar with the adjustment procedures.

2. DIFFERENCE BETWEEN E600 AND E400

◎ Voltage Ratings and Handle Positions of Models

MBA70XXX: E600 body

MBA80XXX: E400 body

	Voltage	Frequency	Current	Left handle side	Right handle side	Condenser handle
MBA70100 MBA80100	100 V	50/60 Hz	0.5 A	Fine adjustment and re-focusing	Coarse, fine, and torque	Right
MBA70200 MBA80200	120 V	Ditto	Ditto	Coarse adjustment fine adjustment, and torque	Fine adjustment and re-focusing	Left
MBA70400 MBA80400	230 V	Ditto	0.3 A	Ditto	Ditto	Ditto

◎ Differences between E600 and E400

		E600	E400
Attached hexagon rod wrench		Opposite side width: 2	Ditto
		Opposite side width: 3 (for clamping sub-stage)	
Revolver	Detachability	Detachable (Rectangular dovetail)	Not detachable
Up-down stroke	Upward	2 mm	Ditto
	Downward	23 mm	28 mm
Sub-stage	Detachability	Detachable (Inserted in up-down dovetail.)	Not detachable (Fixed to up-down unit.)
	15 mm lowering	Possible	Impossible
	Centering	Impossible	Possible
Dia-scopic illumination		See description on dia-scopic illuminator (on page 14).	
Light source	Lamp	12 V, 100 W (3 to 12 V variable)	6 V, 30 W (2 to 6 V variable)
	Lamp house	Optional (MBE75200)	Built-in
Photo-switch	Set voltage	9 V ± 2 steps	4.7 V ± 2 steps
	Voltage adjustment	0.5 V/step	0.4 V/step

3. REMARKS FOR REPAIR

○ For cross head type screws, use a cross head screwdriver which fits the screws.

○ Clean plastic parts with neutral detergent. If organic solvent (ether, thinner, alcohol or the like) is used for cleaning, plastic parts may be discolored or deteriorated.

○ As for glass parts, blow out dust with an air blower, then wipe them with lens cleaning paper moistened with alcohol or mixture of alcohol and ether.

[Instructions on Connecting Power Cable with E600/E400]

★ Deactivate the power switch. Make sure that the marked power source rating is identical to the voltage of the available electric power source. The use on improper voltage may result in breakdown, fire or electric shocks.

Specified Input Voltages
100 to 120 V regions: 100 to 120 V ±10%
220 to 240 V regions: 220 to 240 V ±10%

★ Be sure to connect a grounding line between the microscope and earth in order to prevent electric shocks or electrocution when a 2-core adapter plug is connected with the 3-core cable plug.

[Replacing Fuse]

★ Be sure to use a fuse which meets the rating shown on the rating label stuck near the fuse, on electrical circuit board, etc. In other words, use a fuse equivalent to the built-in fuse (UL-rated or VDE-rated fuse).

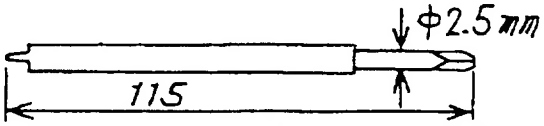
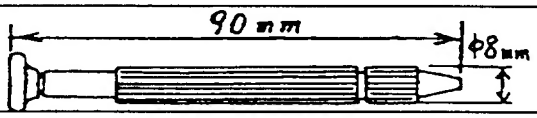
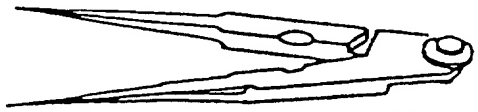
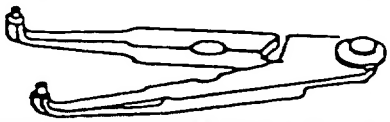
★ Follow the instruction shown above not only for the microscope body but for the accessories (such as the controller).

★ If a fuse not meeting the rating is used, it may blow out when turning on or off the power, resulting in breakdown or a fire in some cases.

★ Deactivate the power switch and disconnect the power cable, then replace the fuse in order to prevent electric shocks or electrocution.

4. TOOLS FOR GENERAL USE AND PREPARATIONS

Tools for General Use

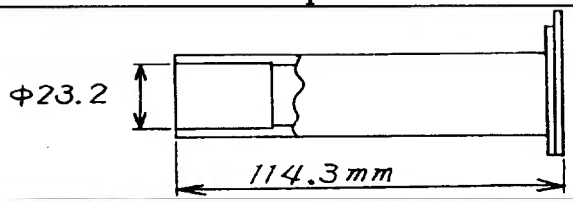
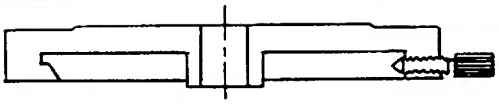
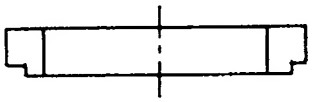
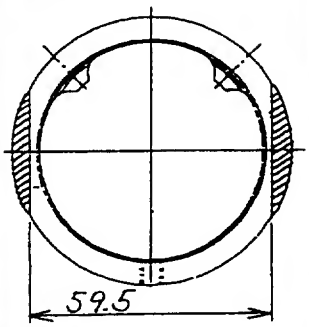
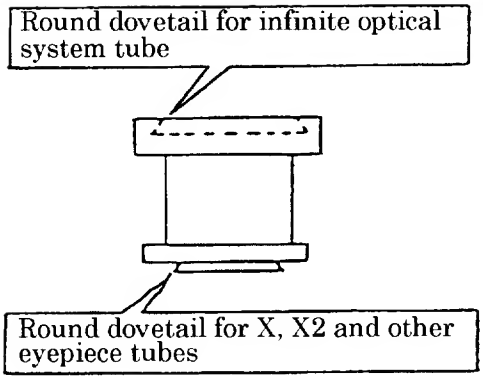
Tool No.	Tool name	Shape
T91400	Cross head screwdriver set	Set of four
T91000	Flat head screwdriver set	Set of six
T91204	Cross head screwdriver with a wooden handle	6 mm dia.
T91102	Flat head screwdriver with a wooden handle	5.5 mm wide
T91305	Cross head screwdriver bits (JCIS M2 & M2.6 screws)	
T91320	Cross head screwdriver bit holder	
T92041	Tweezers AA	
T92162	Compass spanner A	
T92163	Compass spanner B	
E719	Alcohol container	
J21084	Hexagon rod wrench set	Ball-point long type wrenches (Set of six)

Preparations

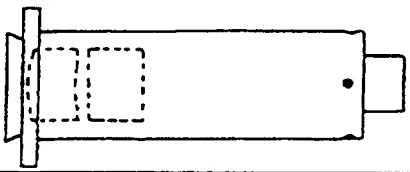
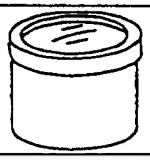
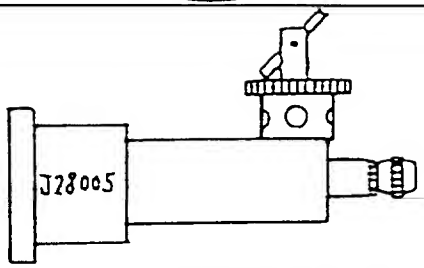
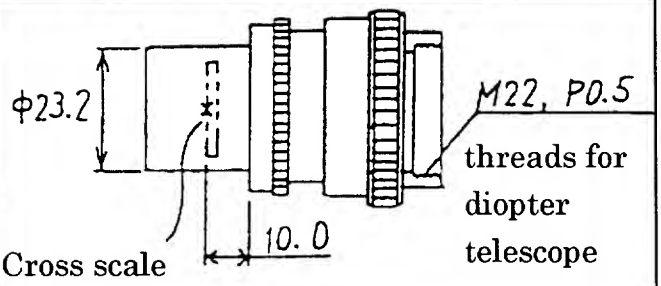
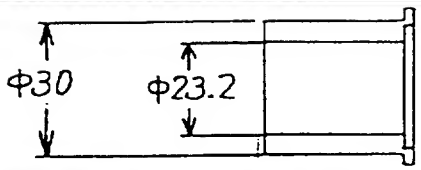
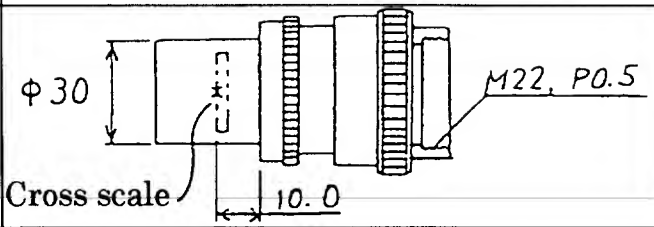
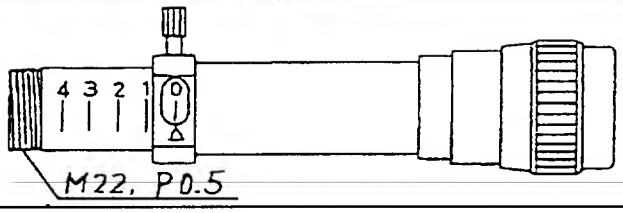
Alcohol (or mixture of alcohol and ether), lens cleaning paper, bamboo sticks (for applying lubricant and adhesive), air blower, dial gauge, EPI 10X objective lens, and eyepiece (CFUWN10XM)

Lubricant and adhesive: Refer to the repair parts list KR-7348.A/7349.A

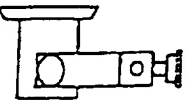
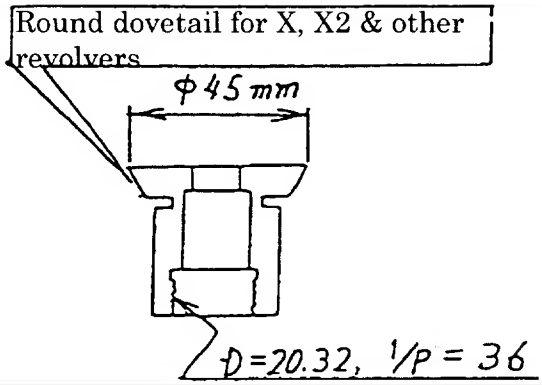
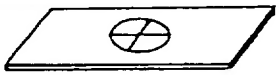
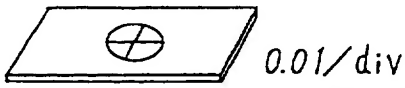
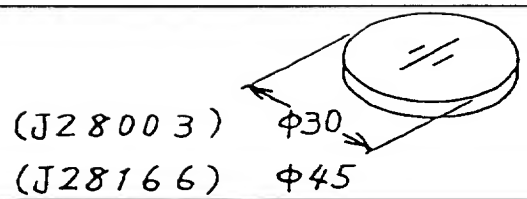
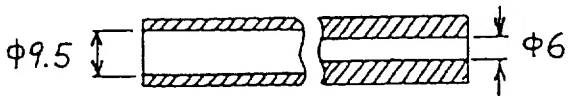
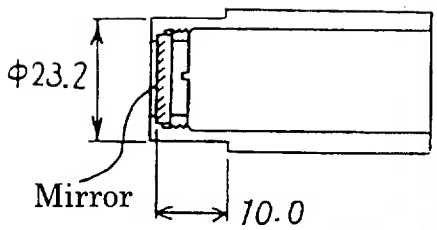
5. TOOLS FOR EXCLUSIVE USE

Tool No.	Tool name	Shape
J25349 (New part)	Binocular unit tool tube for E600/E400	
J25348 (New part)	Sub-stage tool for E400	 This tool is also mountable to the E600, though it cannot be used to adjust the E600 sub-stage. (See page 30.)
J25352 (New part)	Eyepiece height difference measuring tool (Set of two)	
J25303 or J25303 New	Round dovetail adapter  The shaded portions of J25303 New are cut to the shown dimension(59.5 mm). These portions of J25303 are not cut.	

5. TOOLS FOR EXCLUSIVE USE

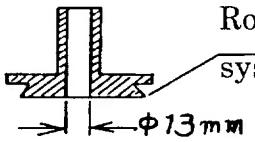
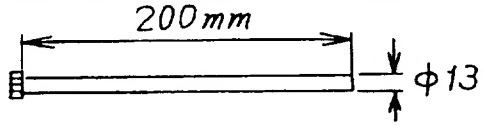
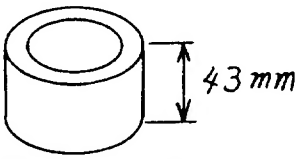
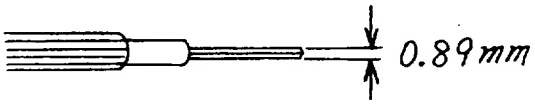
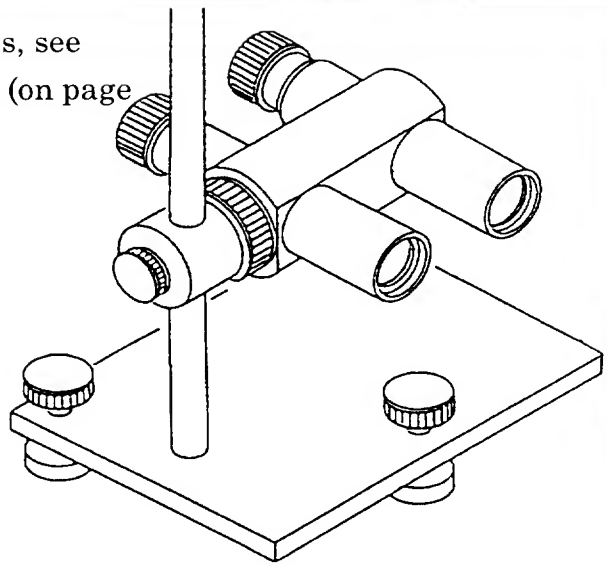
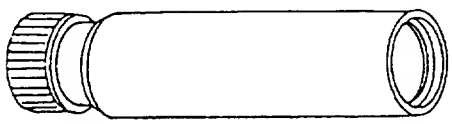
Tool No.	Tool name	Shape
J25295	Standard tube	
J25304	1X objective lens for parfocal adjustment (Infinite optical system)	
J28005	1-minute collimator	
J25220	10X cross eyepiece	
J25260	Ph tool ring Standard → UW eyepiece conversion	
J25221	15X cross eyepiece (for UW) Set of J25220 and J25260 is usable as substitute.	
J29102	Diopter telescope	

5. TOOLS FOR EXCLUSIVE USE

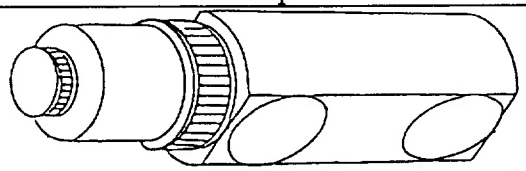
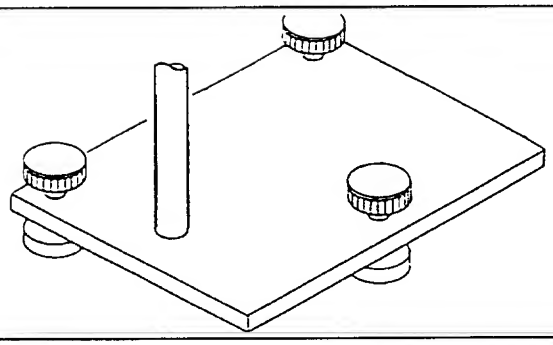
Tool No.	Tool name	Shape
J25262	Dial gauge holder	Detach revolver, then attach dial gauge holder. 
J25264	Objective mount	
J25194	Cross slit specimen	
J28004	Grating specimen	
J28003 or J28166	Parallel mirror	
J27241	Grip exclusive for hexagon key	
J28163	Eyepiece mirror tool	

Parallel mirror (J28003) is usable as substitute.
For details, see ③ and ④ on page 70.

5. TOOLS FOR EXCLUSIVE USE

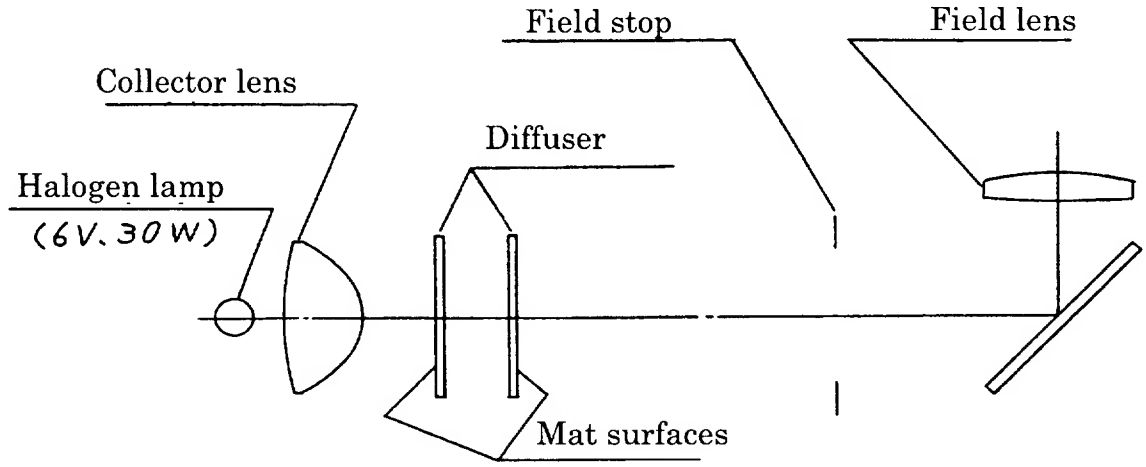
Tool No.	Tool name	Shape
J25298	Centering tool	
J25275	Centering rod	
J25291	Condenser upper limit stopper positioning tool	
J25283	Exclusive hexagon key (for M2 set screws)	
J28173	Parallel collimator ★ Can be set to any depression angle.	★ For details, see Section 15-4 (on page 40). 
J28173A	Collimator unit of J28173	

5. TOOLS FOR EXCLUSIVE USE

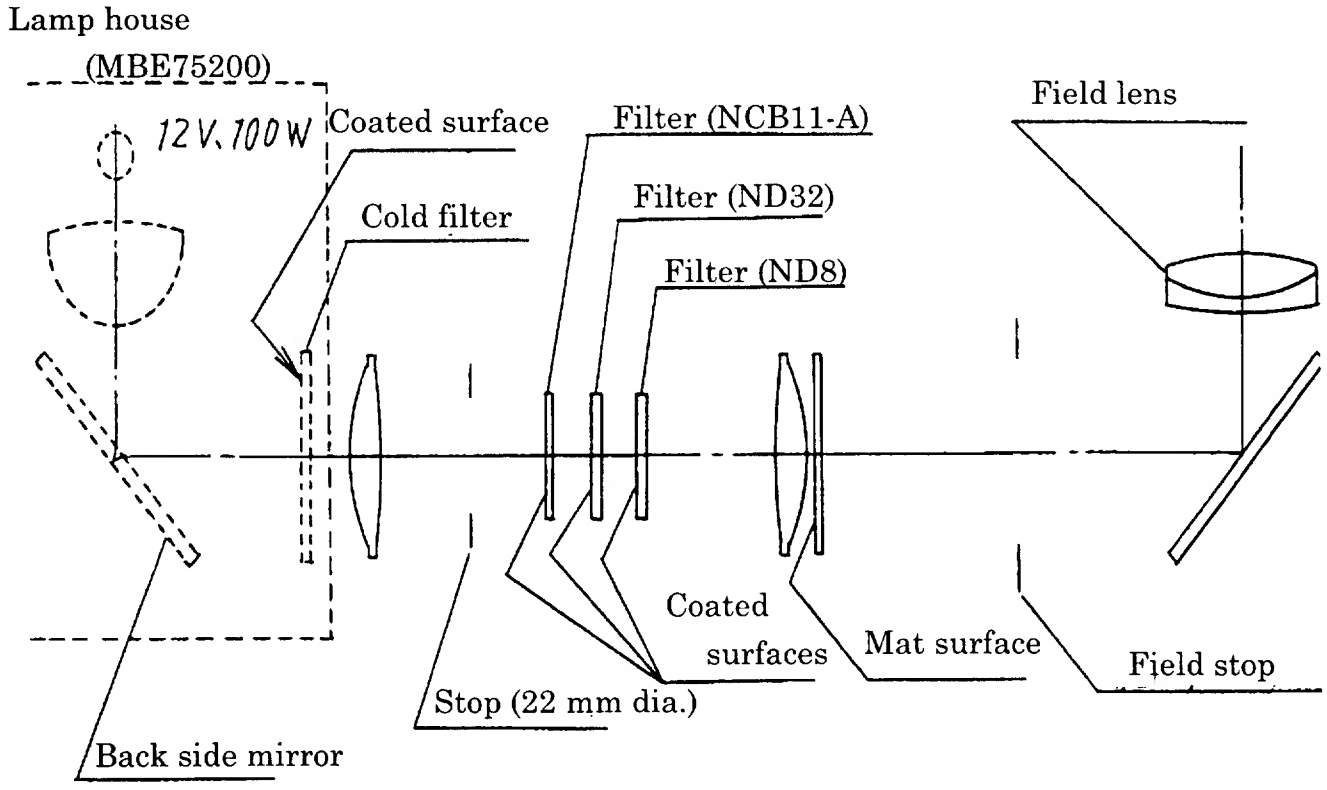
Tool No.	Tool name	Shape
J28173B	Collimator holder unit of J28173	
J28173C	Base unit of J28173	

6. OPTICAL SYSTEM FOR DIA-SCOPIC ILLUMINATION

E400



E600

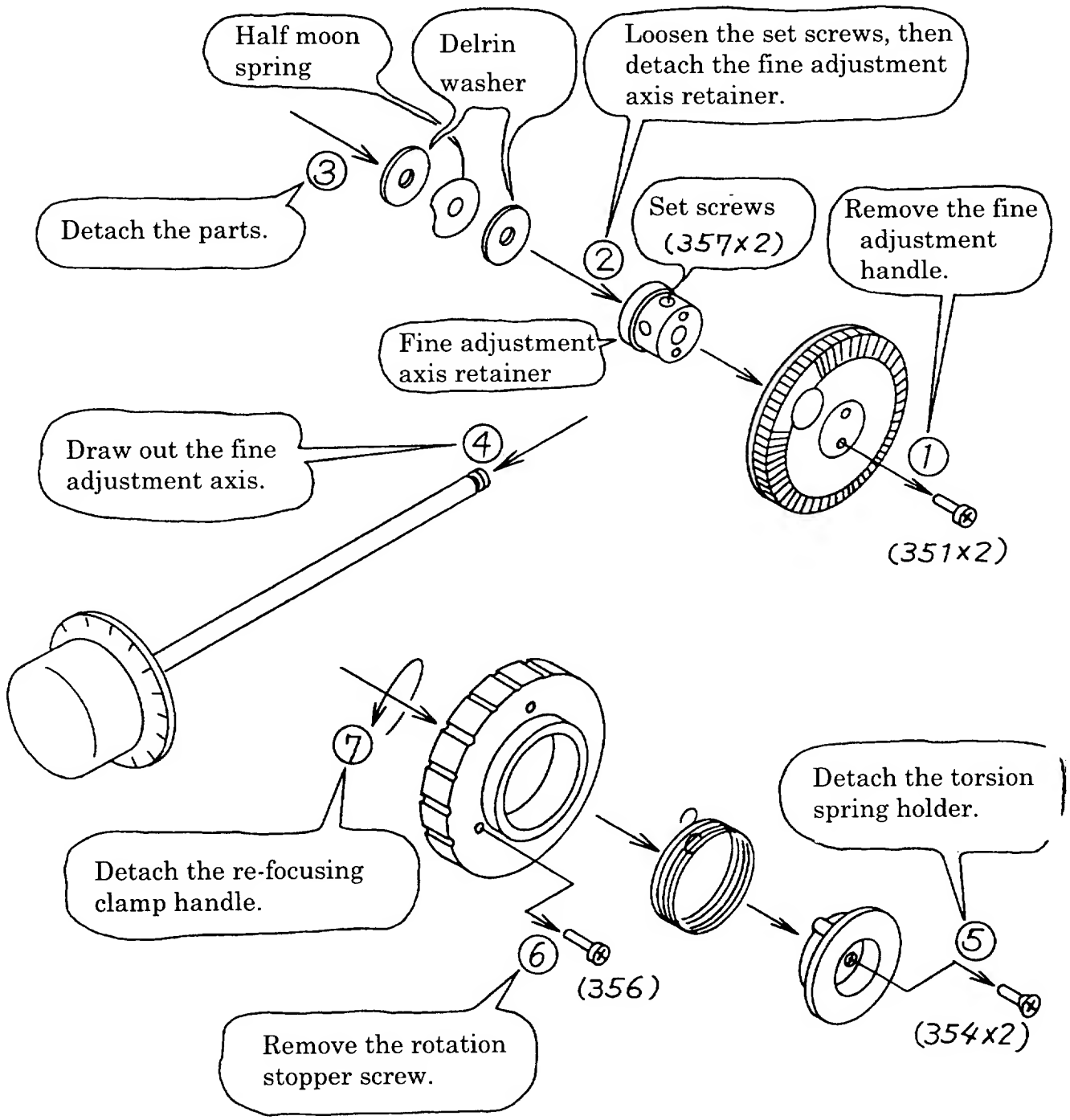


7. DISASSEMBLY OF UP-DOWN AXIS ① → ⑦

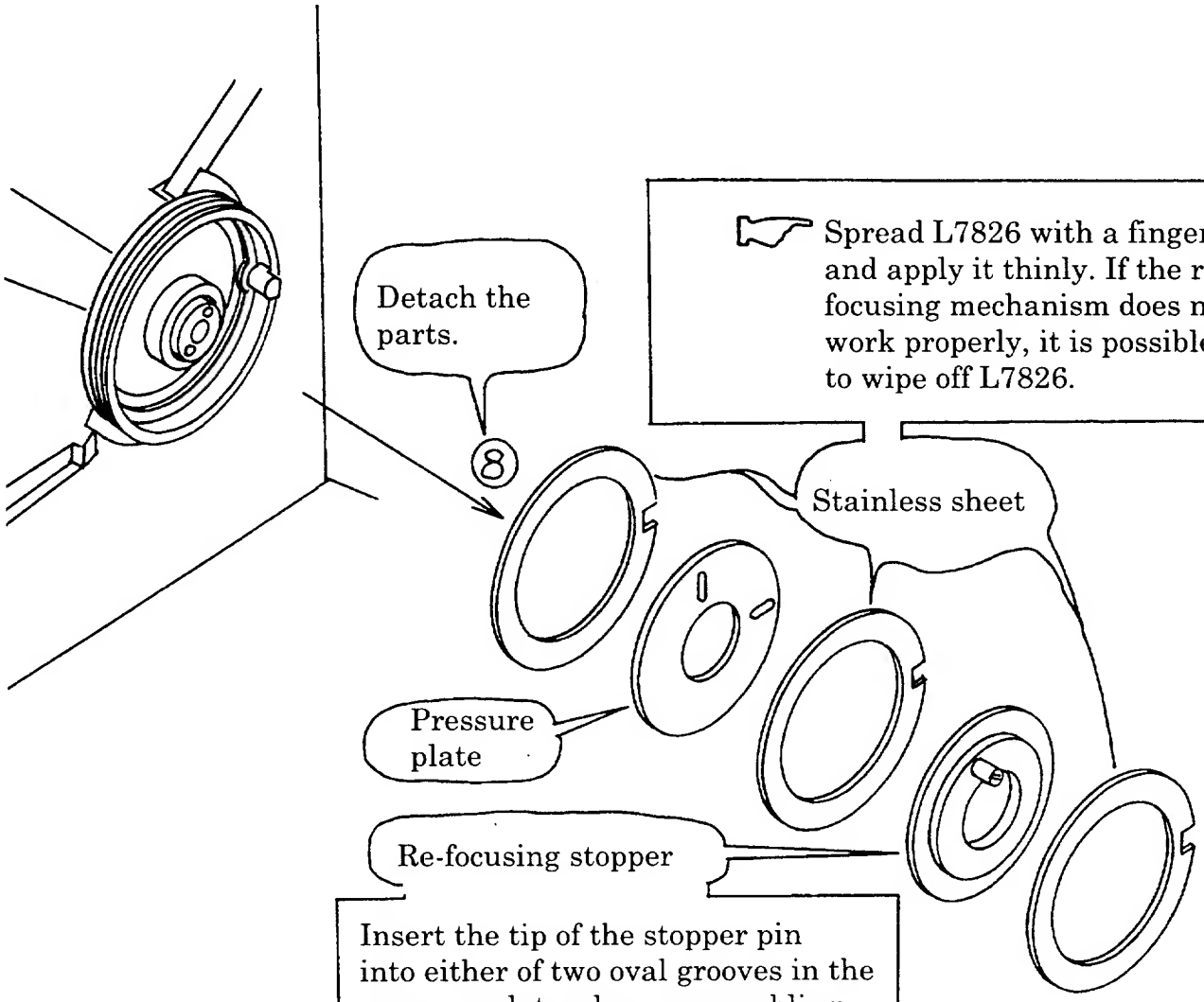
◎ There are two types of microscopes: 120/230 V type microscopes with the coarse adjustment handle on the left, and 100 V type microscopes with the coarse adjustment handle on the right. (See page 6.)

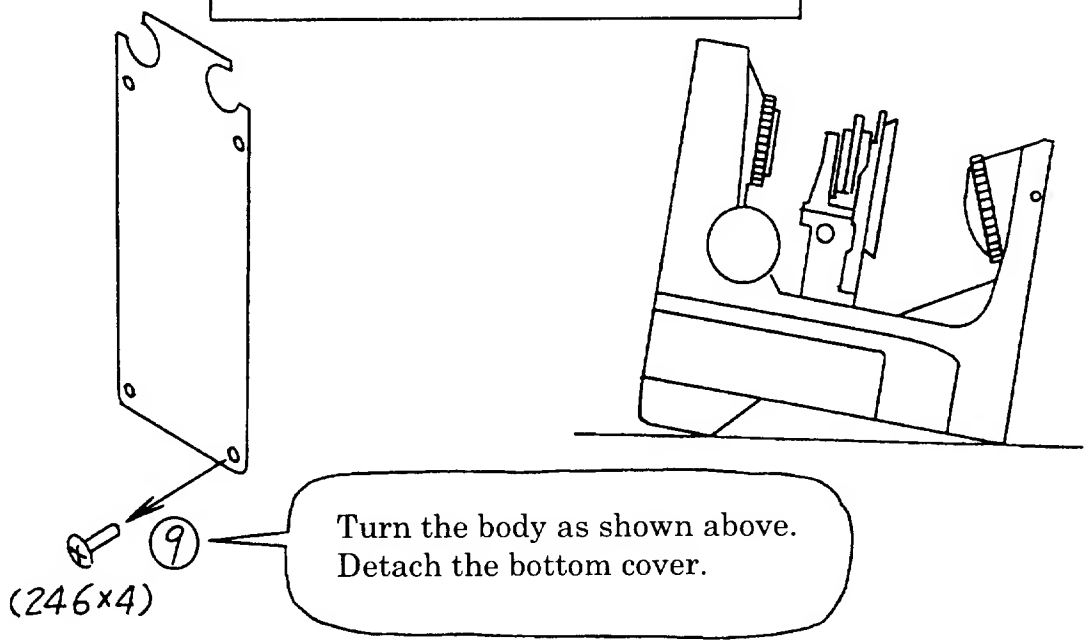
◎ This section takes an example of disassembling the up-down axis of a microscope with the coarse adjustment handle on the left.

Both types of microscopes have quite the same structure, with the only exception that the parts are located on the symmetrical positions on the right and left.

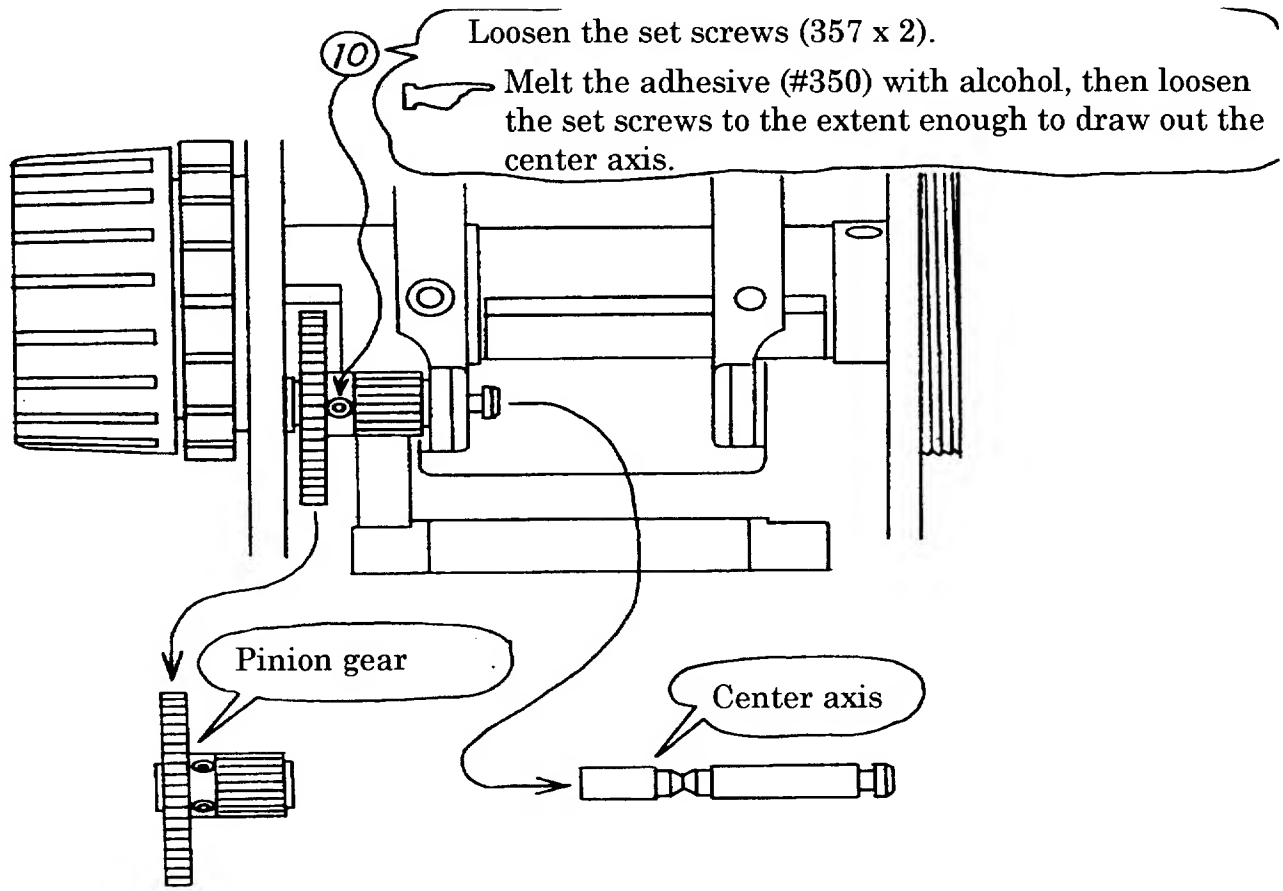


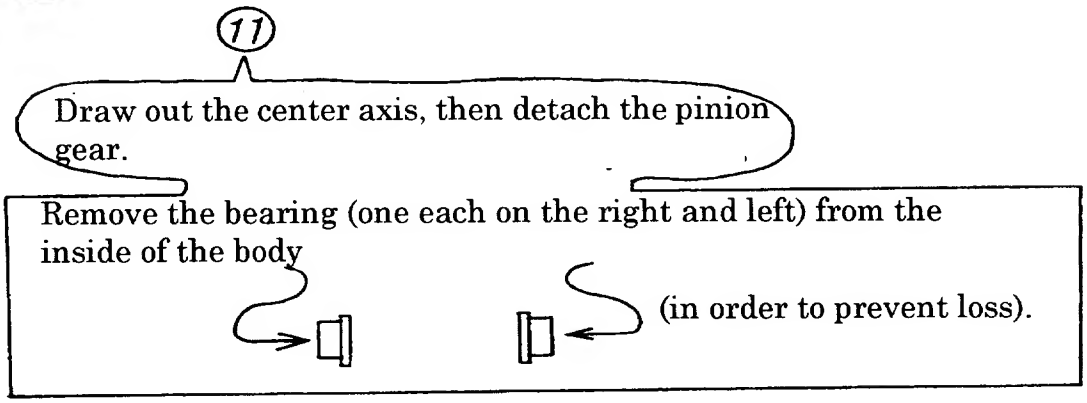
7. DISASSEMBLY OF UP-DOWN AXIS ⑧ → ⑨


Detach the parts.
⑧
Spread L7826 with a finger and apply it thinly. If the re-focusing mechanism does not work properly, it is possible to wipe off L7826.
Stainless sheet
Pressure plate
Re-focusing stopper
Insert the tip of the stopper pin into either of two oval grooves in the pressure plate when reassembling the parts.



7. DISASSEMBLY OF UP-DOWN AXIS ⑩ → ⑪

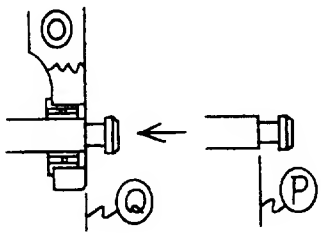

10
Loosen the set screws (357 x 2).
Melt the adhesive (#350) with alcohol, then loosen the set screws to the extent enough to draw out the center axis.
Pinion gear
Center axis


11
Draw out the center axis, then detach the pinion gear.
Remove the bearing (one each on the right and left) from the inside of the body
(in order to prevent loss).

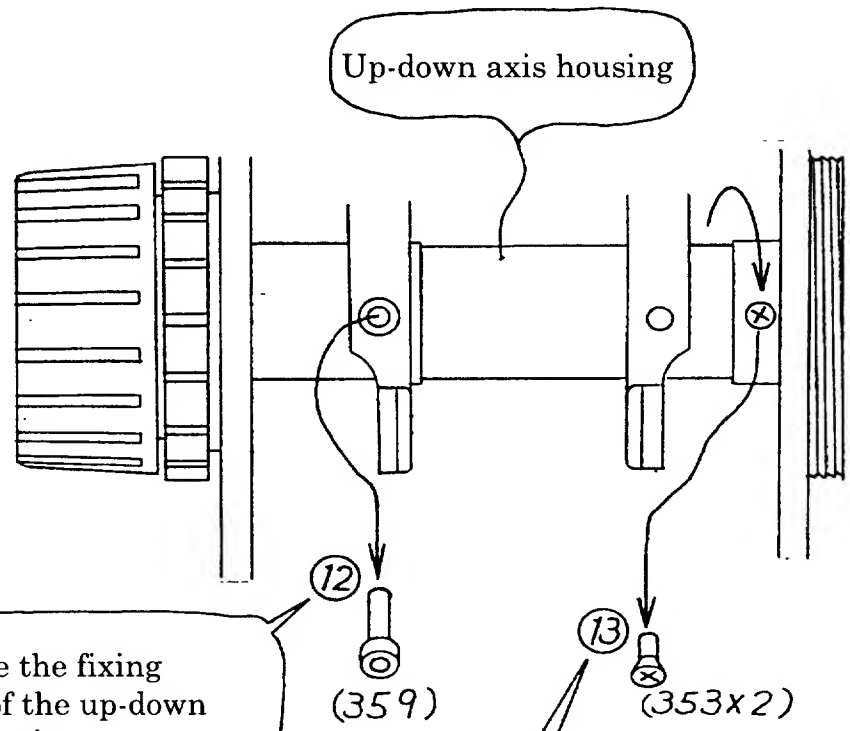
★ Precautions in reassembly

If the center axis is pressed too much, it will not be drawn out. To be exact, it is necessary to draw out the coarse adjustment axis then to remove the torque adjusting handle for taking out the center axis.

Press the center axis until the surface Ⓟ becomes flush with the surface Ⓠ, then tighten the set screws (357 x 2).



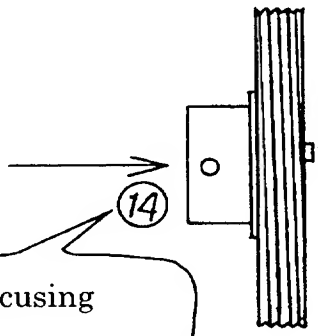
7. DISASSEMBLY OF UP-DOWN AXIS ⑫ → ⑭



Remove the fixing screw of the up-down axis housing.

Rotate the coarse adjustment handle until the flat countersunk head screw faces to the front, then remove the flat countersunk head screw.

★ If adhesive (#410B/M) penetrated into the threads, strong force is needed to remove the screw.
Use a cross head screwdriver which fits the groove properly in order not to damage the groove.



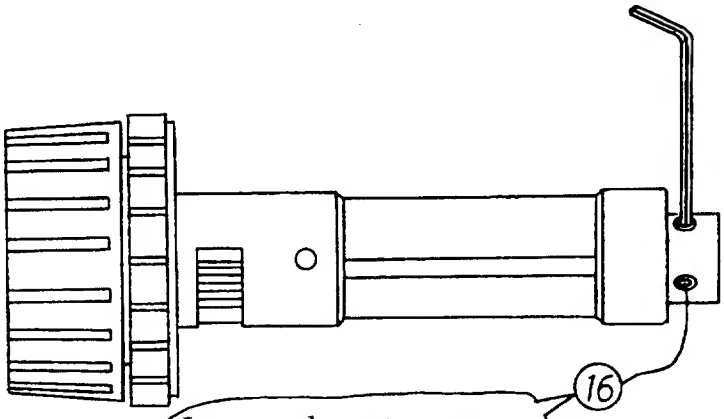
Rotation stopper

It may be located at the upper or lower position when reassembled.

Detach the re-focusing housing.

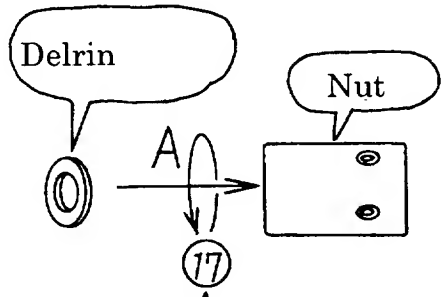
7. DISASSEMBLY OF UP-DOWN AXIS ⑮ → ⑱

⑮ Draw the whole up-down axis out of the microscope body.



Loosen the set screws (358 x 2).

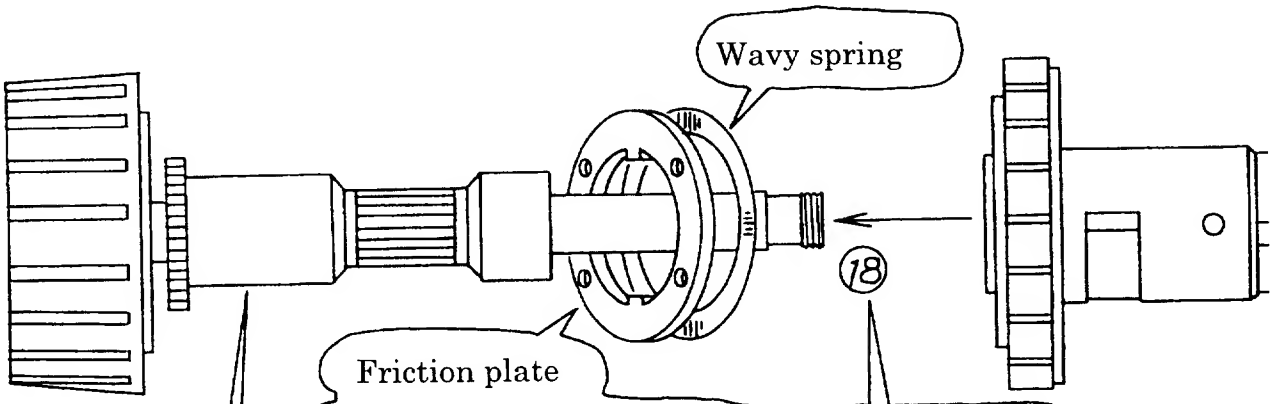
★ Rotate each set screw by two turns or more.
-- In order to prevent the threads at the tip of the coarse adjustment axis from being damaged when removing the nut.



Remove the nut.

Hold the coarse adjustment handle with the left hand, insert the hexagon key into the set screw as shown above, then turn the nut counterclockwise (in the direction of A).

★ When reassembling, screw in the nut until it stops rotating, i.e., it is pressed against the abutting joint.



Friction plate

Assemble so that the oil sump side faces to the outside.

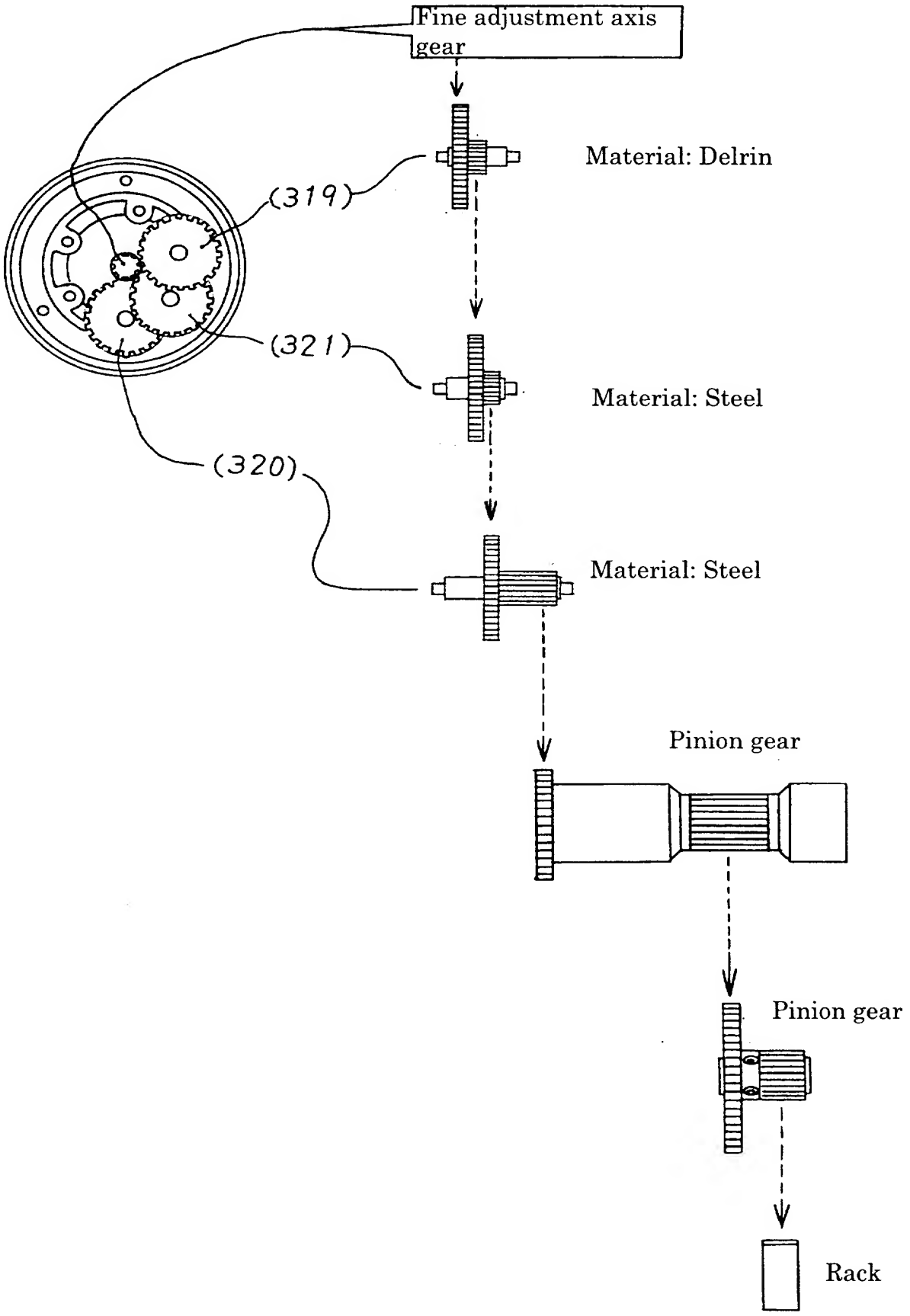
Draw out the coarse adjustment axis.

Pinion gear

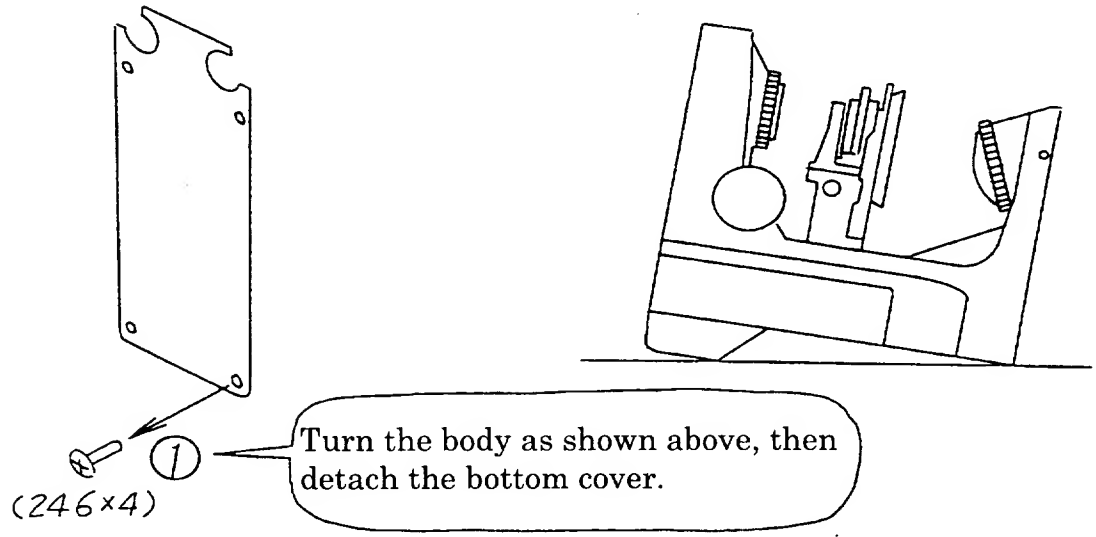
Bearings are set on both sides.

For the details of the gears in the handle, see the following page.

7. DISASSEMBLY OF UP-DOWN AXIS (ORDER OF GEAR TRAIN)



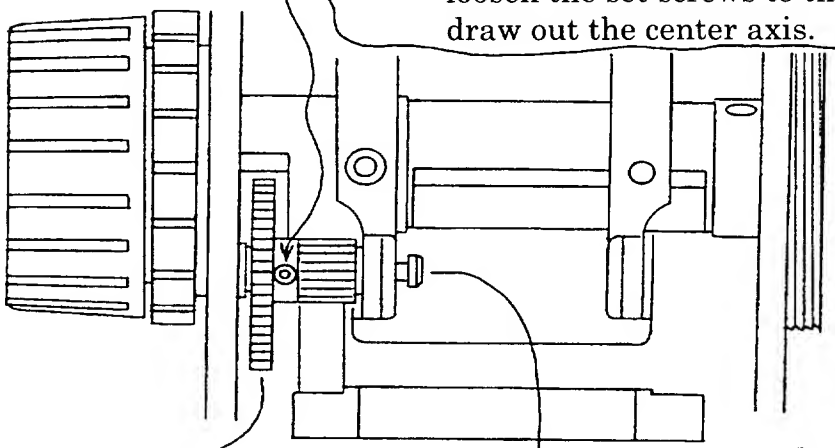
8. DISASSEMBLY OF UP-DOWN UNIT ① → ③

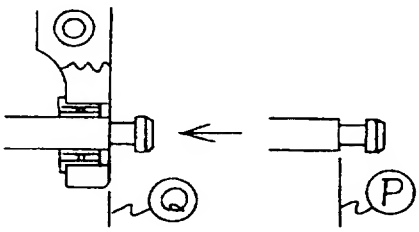


(246×4)

① Turn the body as shown above, then detach the bottom cover.

② Loosen the set screws (357 x 2).
Melt the adhesive (#350) with alcohol, then loosen the set screws to the extent enough to draw out the center axis.

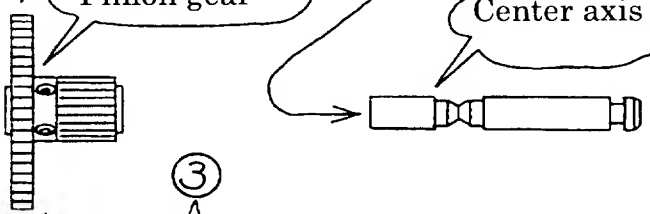




★When reassembling, press the center axis until the surface Ⓟ becomes flush with the die cast surface Ⓠ, then tighten the set screws (357 x 2).
See the note on page 17.

Pinion gear

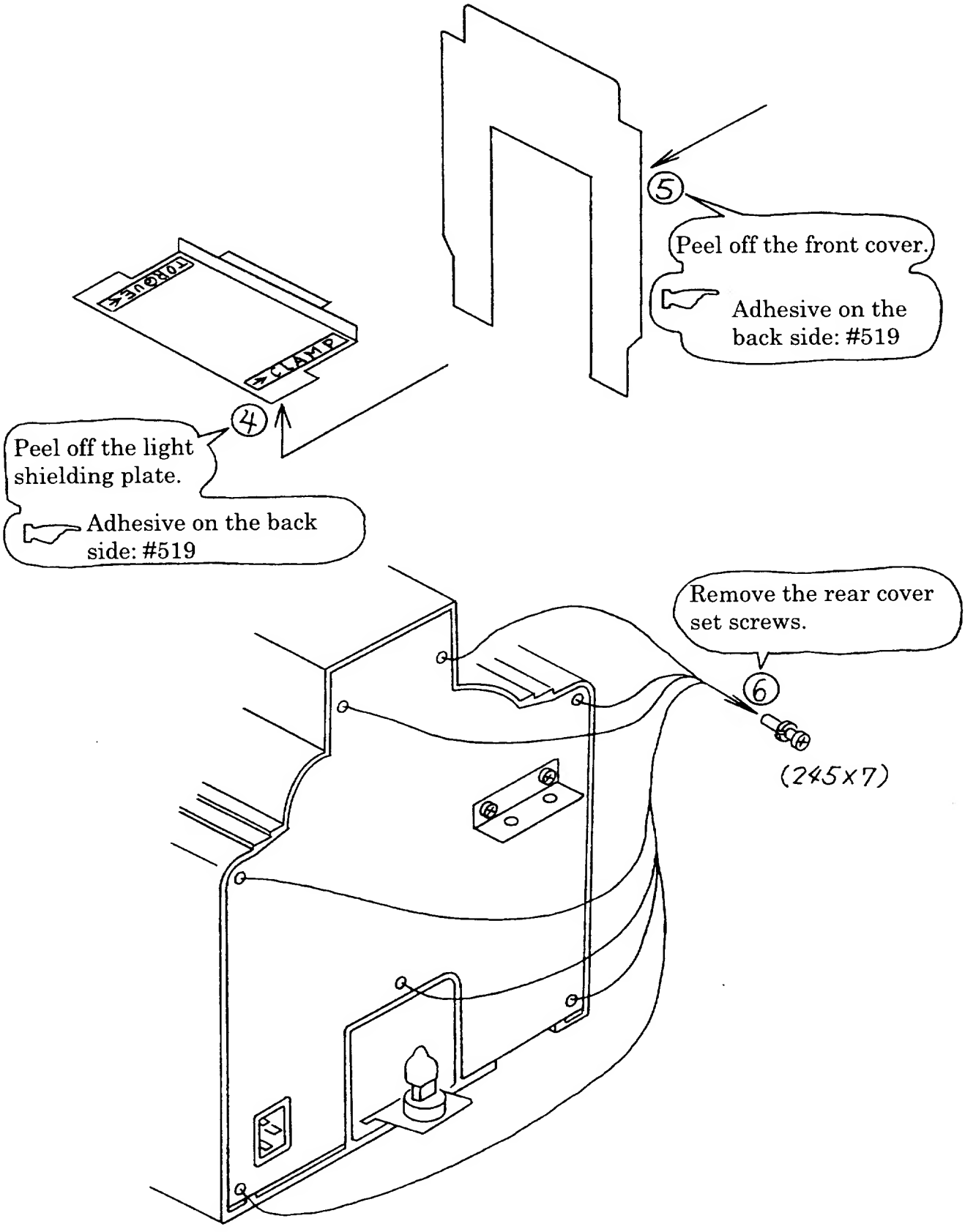
Center axis



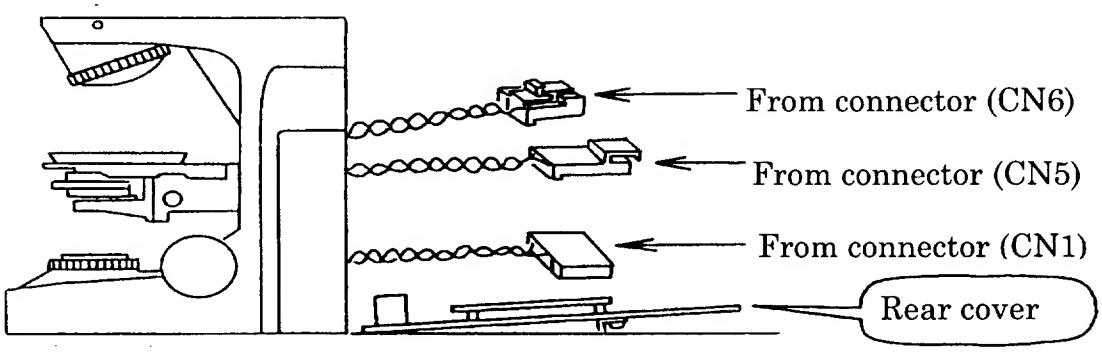
③ Draw out the center axis, then detach the pinion gear.

Remove the bearing (one each on the right and left) from the inside of the body (in order to prevent loss).

8. DISASSEMBLY OF UP-DOWN UNIT ④ → ⑥

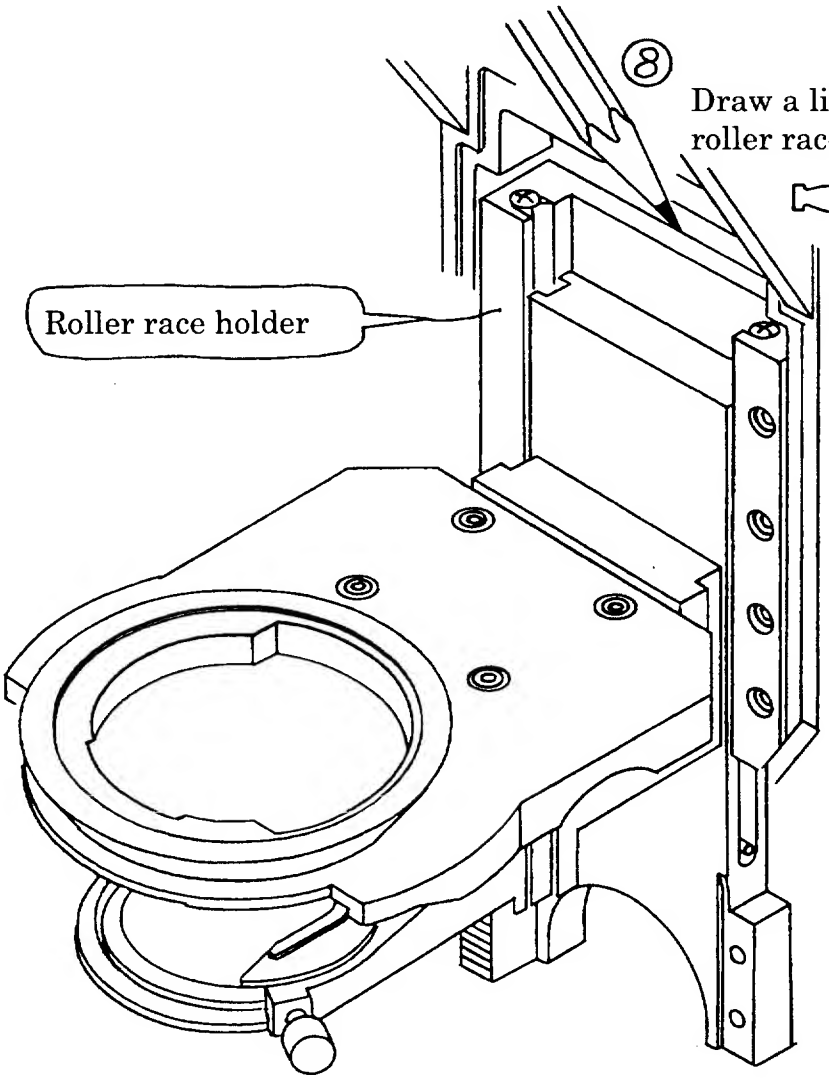


8. DISASSEMBLY OF UP-DOWN UNIT ⑦ → ⑧



⑦

Draw out three connectors from the board as shown above. Then, turn the rear cover.

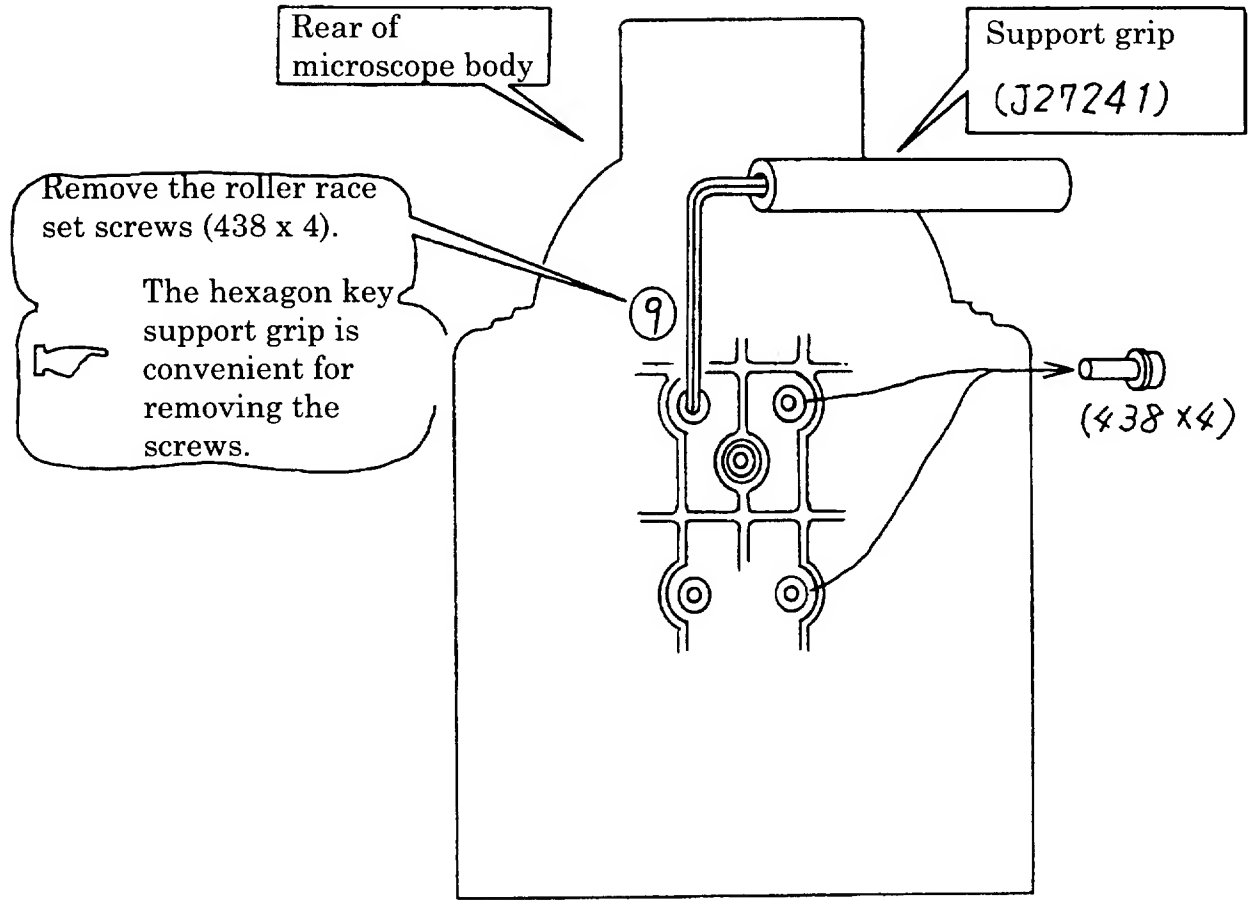


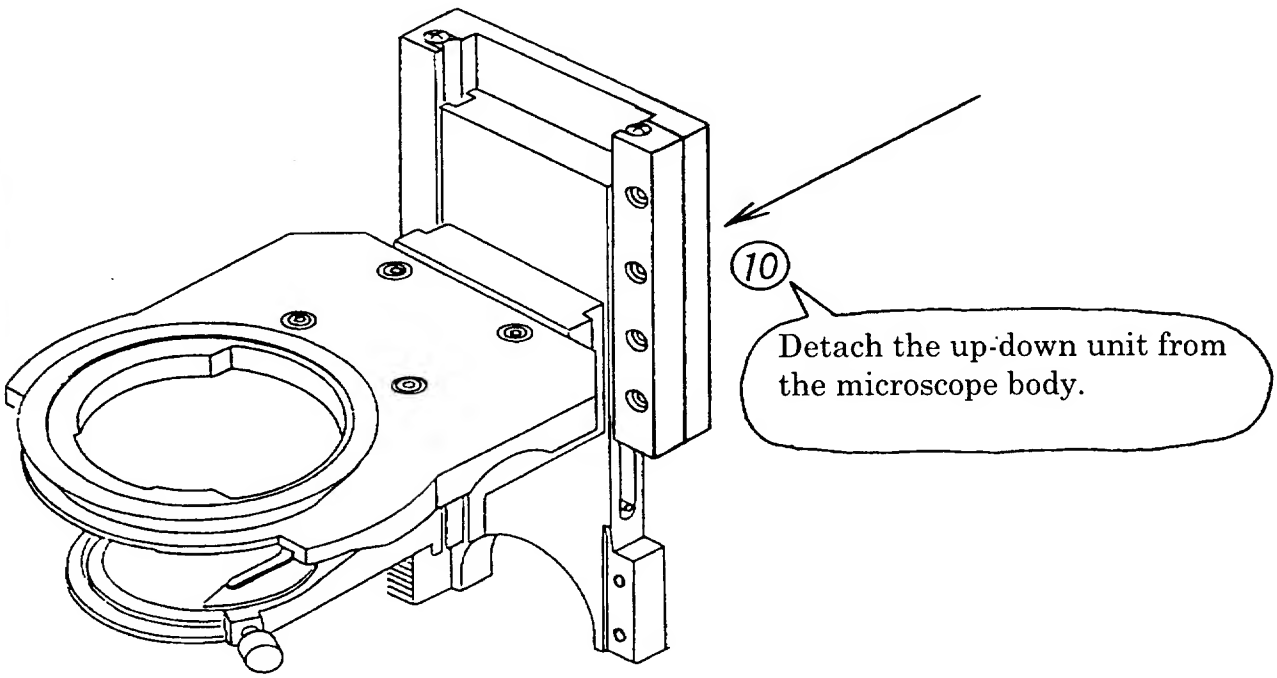
Draw a line along the border between the roller race holder and microscope body.

This line serves as the guide line when reassembling the parts.

★ The adjustment shown in Section 12 is required after reassembly.

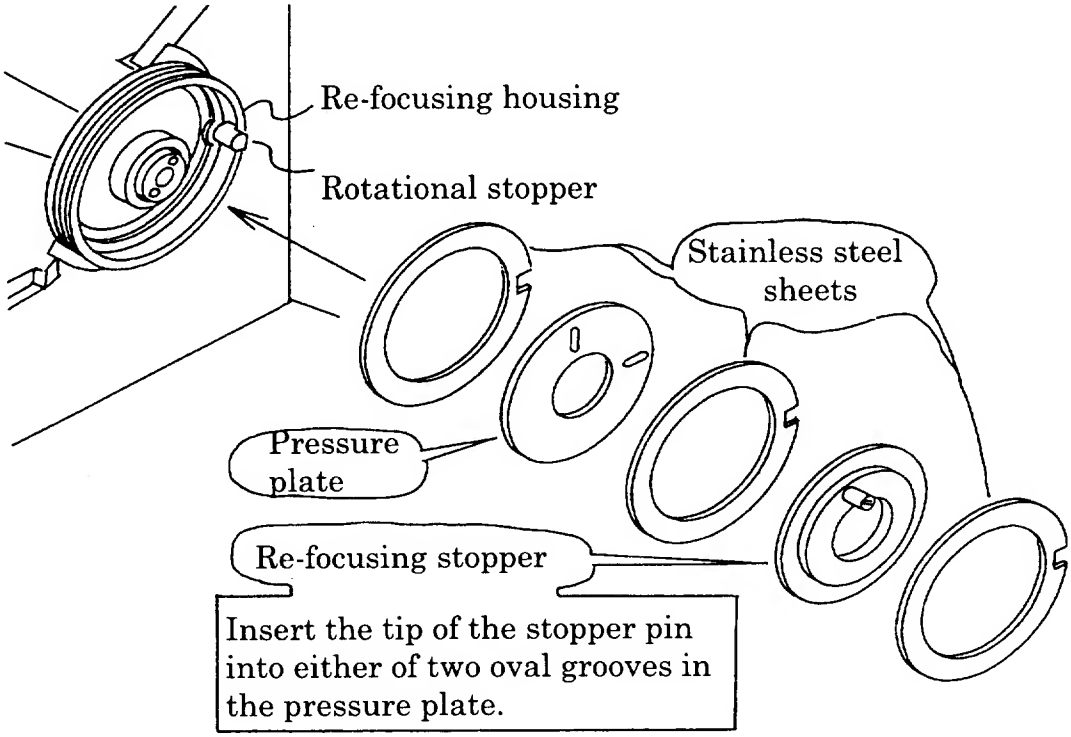
8. DISASSEMBLY OF UP-DOWN UNIT ⑨ → ⑩


Rear of microscope body
Support grip
(J27241)
Remove the roller race set screws (438 x 4).
The hexagon key support grip is convenient for removing the screws.
⑨
(438 x4)



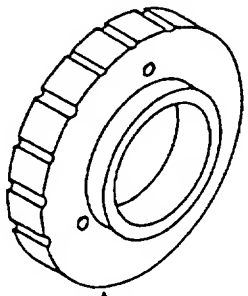
9. ASSEMBLY OF RE-FOCUSING CLAMP

① Assemble the stainless steel sheets (three), pressure plate, and re-focusing stopper into the housing.

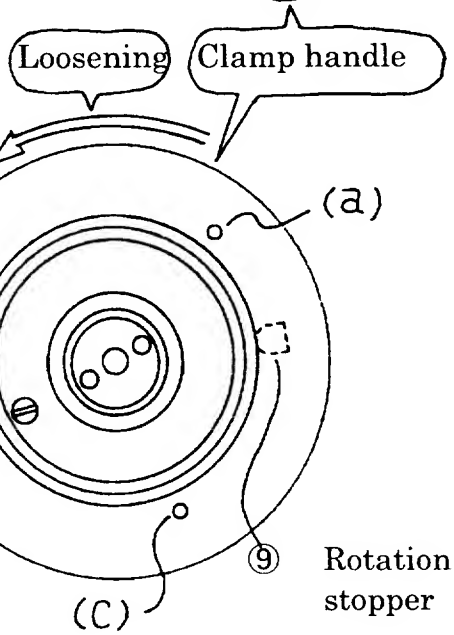


Insert the tip of the stopper pin into either of two oval grooves in the pressure plate.

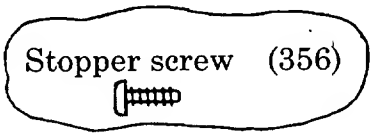
② Screw the re-focusing clamp handle into the housing to tighten.



★ Before screwing, remember the position of the rotation stopper on the housing (as shown above).



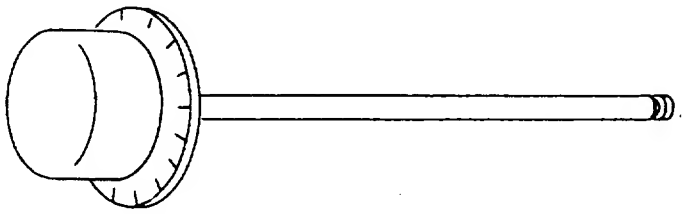
③ Screw the stopper screw into one of the three holes (a, b and c) in the front side of the clamp handle.



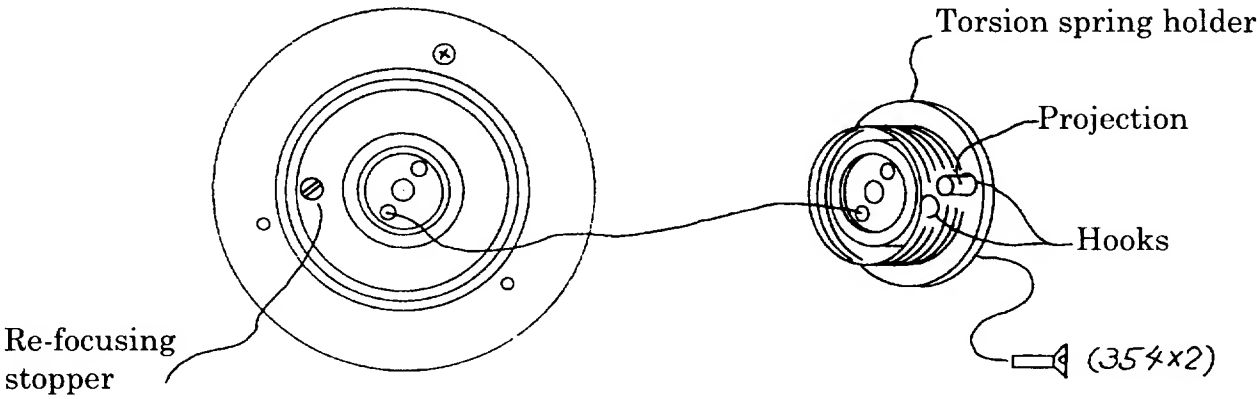
★ Screw the stopper screw into the hole which maximizes the rotational angle of the stopper screw until it hits against the rotational stopper when the clamp handle is loosened.(Hole "a" in the figure on the right)

9. ASSEMBLY OF RE-FOCUSING CLAMP

④ Assemble the fine adjustment axis



⑤ Follow the steps (a) to (d) shown below.



(a) Hook one end of the torsion spring to the projection on the torsion spring holder.

(b) Insert the center hole of the holder into the fine adjustment axis.

(c) Hook the other end of the torsion spring to the re-focusing stopper.

(d) While pressing the torsion spring holder to the back, rotate it counterclockwise by one turn or more (but less than two turns).Press it to the back, and fix it with the flat countersunk head screws (354 x 2).

> ☞ Return the torsion spring holder to the front only when the projection on the holder overrides the re-focusing stopper.

★ Caution

The torsion spring is easily inserted into the bottom of the holder.
Be careful. Do not tighten the flat countersunk head screws with the torsion spring inserted into the bottom of the holder.

To check whether it is inserted, press the holder.
When it is inserted, the holder is unstable and shakes.

9. ASSEMBLY OF RE-FOCUSING CLAMP

⑥ Checking the Re-Focusing Function

(a) Rotate the coarse adjustment handle to raise the sub-stage to a proper position.

(b) Tighten the re-focusing clamp handle.

(c) Move down the sub-stage with the coarse adjustment handle.Then, raise the sub-stage again to make sure that it stops at the re-focusing position.

☞ The projection of the torsion spring holder is pressed against the re-focusing stopper.

(d) Rotate the coarse adjustment handle to move down the sub-stage to some extent.

(e) Loosen the re-focusing clamp handle.

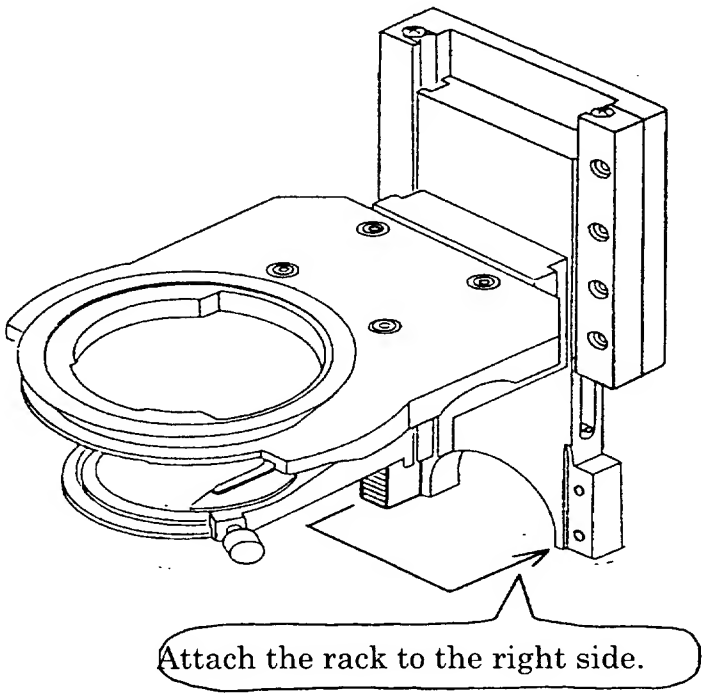
☞ The torsion spring rotates the re-focusing stopper counterclockwise. Make sure that the projection of the torsion spring holder is pressed against the re-focusing stopper and generates a click sound.

10. CHANGING UP-DOWN HANDLE POSITION (RIGHT⟷LEFT)

◎ Note that this is a remarkably troublesome work, and follow the steps shown below.

◎ The description below takes an example of changing the up-down handle position of a microscope with the coarse handle on the left.

① Disassemble the up-down axis and up-down unit in the procedures ① to ⑱ in Section 7 and ① to ⑩ in Section 8 above.

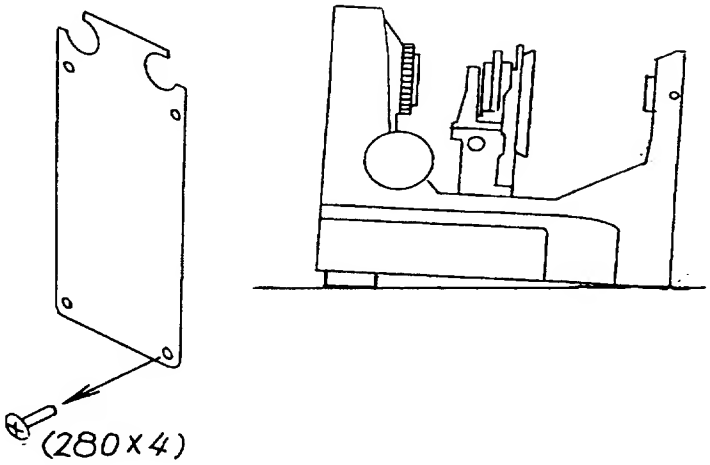


② Detach the rack on the left of the roller race. Attach it to the right side.

③ Reassemble each part in the symmetrical position on the opposite side in the reverse procedures to disassembly.

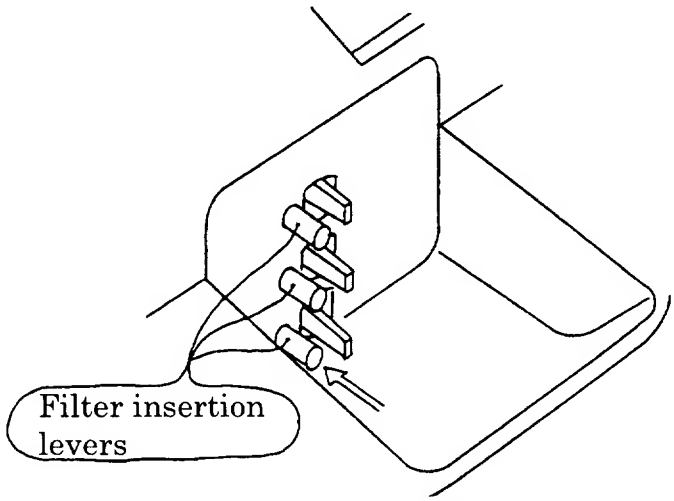
11.DISMOUNTING FILTER UNIT (APPLICABLE TO E600 ONLY)

① Turn the microscope body as shown on the right, and detach the bottom cover.

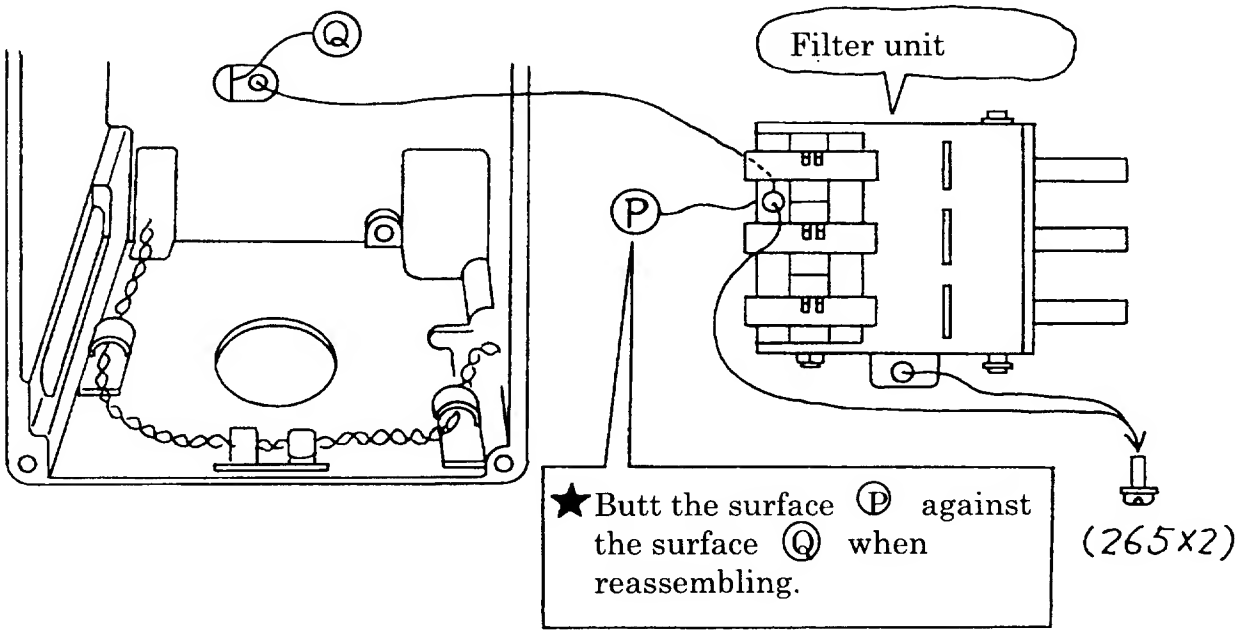


② Insert three filter insertion levers.

☞ Bring the filters to the optical path.



③ Remove the clamp screws (265 x 2) from the inner part. Detach the filter unit.



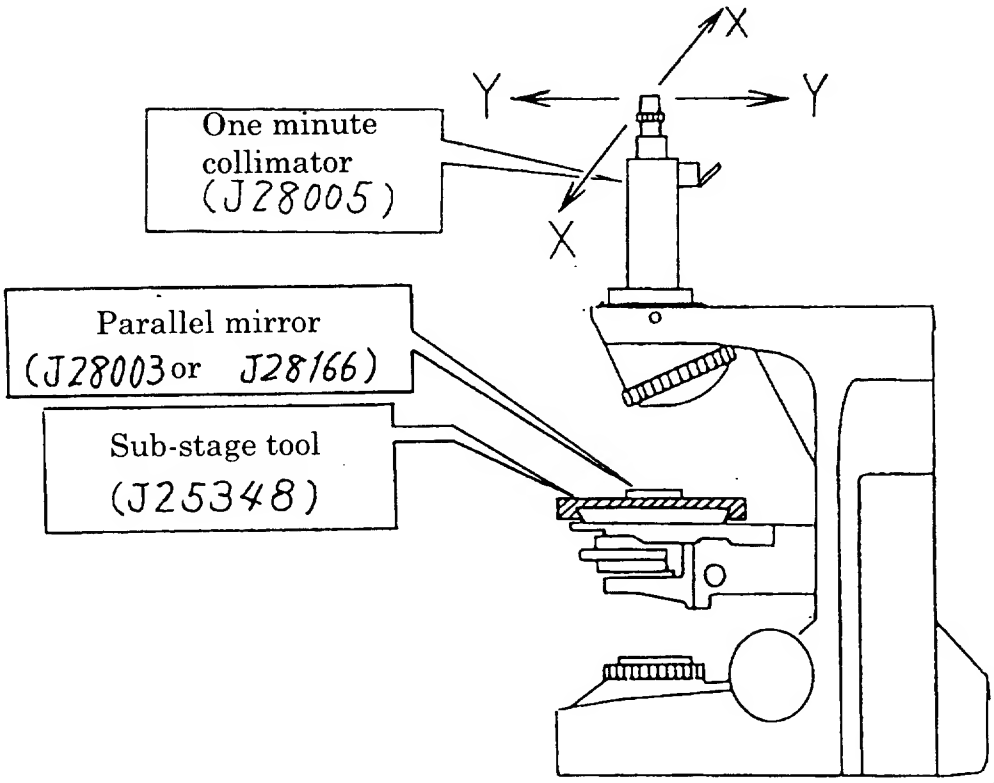
☞ The other parts of the dia-scopic illuminator can be easily detached and reassembled only by inserting them into the reference holes or by butting them to the reference planes.Thus, the disassembly and reassembly procedures of such parts are omitted here.

12. ADJUSTMENT OF SUB-STAGE TILT (APPLICABLE TO E400 ONLY)

◎ The sub-stage tilt of the E600 cannot be adjusted.
In other words, the E600 is so designed that its accuracy is ensured by machining only without the need of adjustment.

When attaching the up-down unit to the microscope body, press it to the left reference plane. The E600 is so designed and machined that the center of the sub-stage round dovetail is accurately aligned to the center of the eyepiece tube mounting round dovetail in this condition. Therefore, the sub-stage round dovetail will be misaligned from the center of the eyepiece tube mounting round dovetail if the up-down unit is tilted in this condition.
The sub-stage is connected to the up-down unit with its dovetail.
Thus, it is impossible to correct the off-center.

This is why the adjustment described in this section applies to the E400 only.

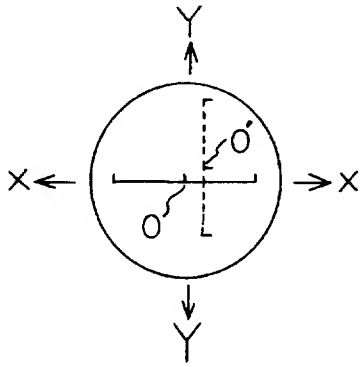


① Set the one minute collimator, sub-stage tool, and parallel mirror to the E400.

☞ Set the collimator with its scale along the X axis as shown above, provided the right-to-left direction is regarded as the X axis and the back-and-forth direction is regarded as the Y axis.

12. ADJUSTMENT OF SUB-STAGE TILT (APPLICABLE TO E400 ONLY)

② Check the shift of the center of the scale image (O') from the scale center (O).



Specifications

Eyepiece tube mounting surface // Objective lens mounting surface: 2' or less

This value depends on the machining accuracy and need not be adjusted.

Objective lens mounting surface // Sub-stage top surface: 3' or less

The standard shift is found from the above-shown specifications as shown below:

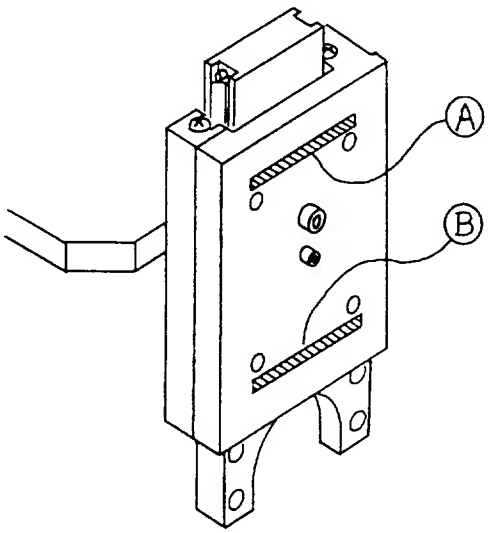
Eyepiece tube mounting surface // Sub-stage top surface: 5' or less

Minimize the shift as shown below.

Correction in Y direction

(a) Detach the up-down unit in the procedures ①→⑩ in Section 8.

(b) Stick brass foil or the like to the shaded portion A or B on the rear of the unit according to the shift direction (upward or downward) of O' (using #350 adhesive).

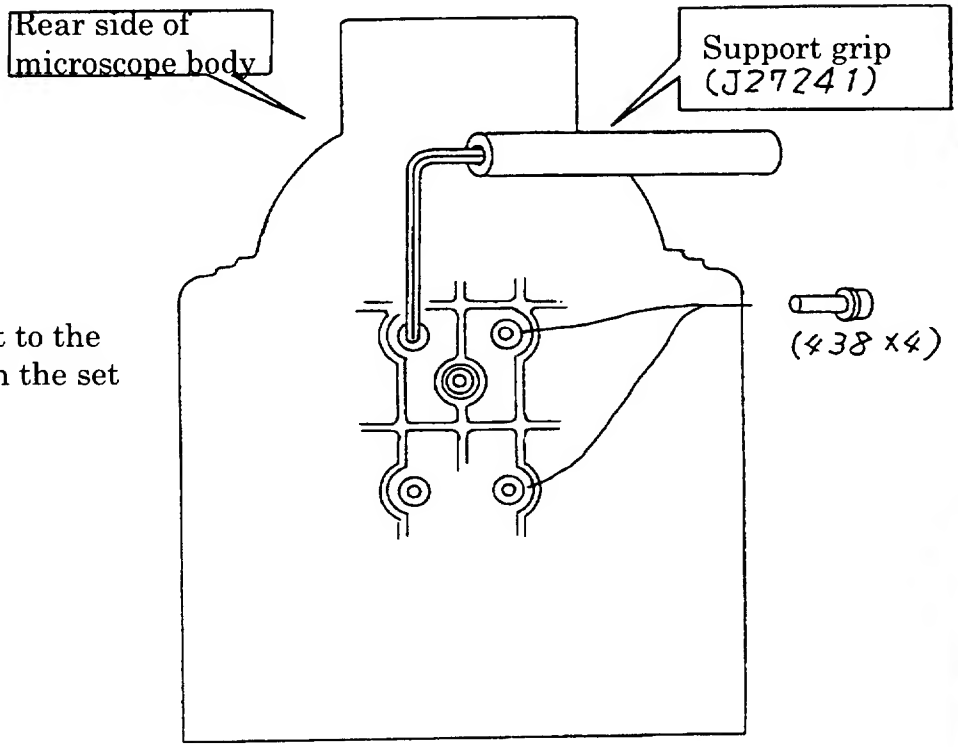


Standard foil thickness: 0.02 mm/1'

☞ Tilt adjusting liners (such as brass foil liners) are not available as parts.

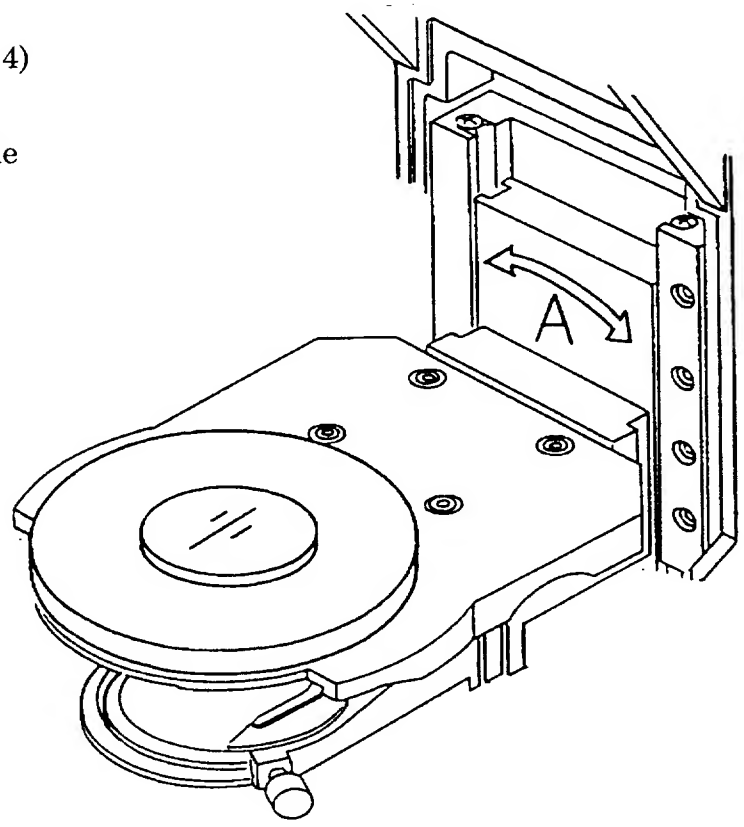
12. ADJUSTMENT OF SUB-STAGE TILT (APPLICABLE TO E400 ONLY)

Correction in X direction

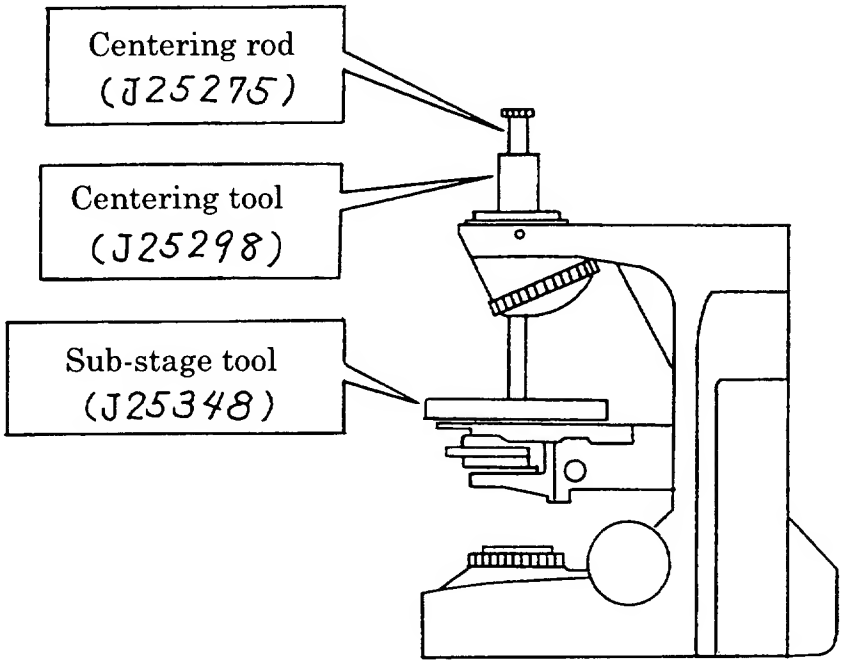


(a) Fix the up-down unit to the microscope body with the set screws (438 x 4).

(b) Loosen the set screws (438 x 4) slightly.Tilt the unit in the direction of A as shown on the right.



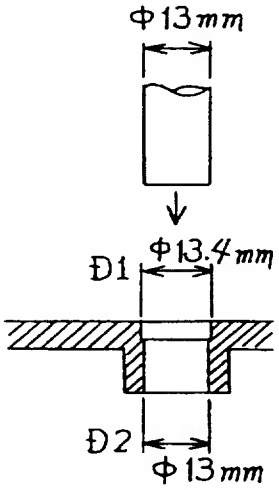
13. CENTERING OF SUB-STAGE (APPLICABLE TO E400 ONLY)



① Attach the centering tool to the eyepiece tube mounting round dovetail.

② Attach the sub-stage tool to the sub-stage round dovetail.

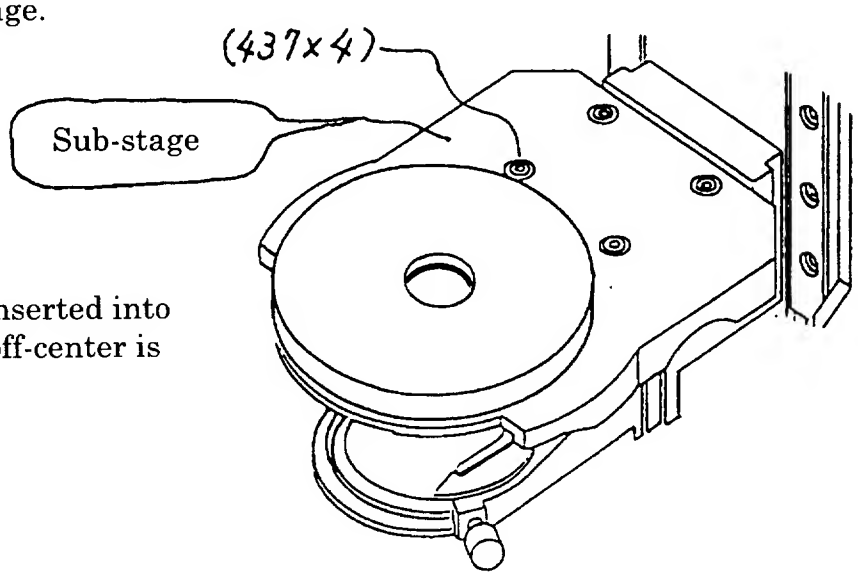
③ Insert the centering rod into the centering tool to check whether its top is inserted into the upper hole D1 in the sub-stage tool.



Standard off-center: 0.2 mm or less

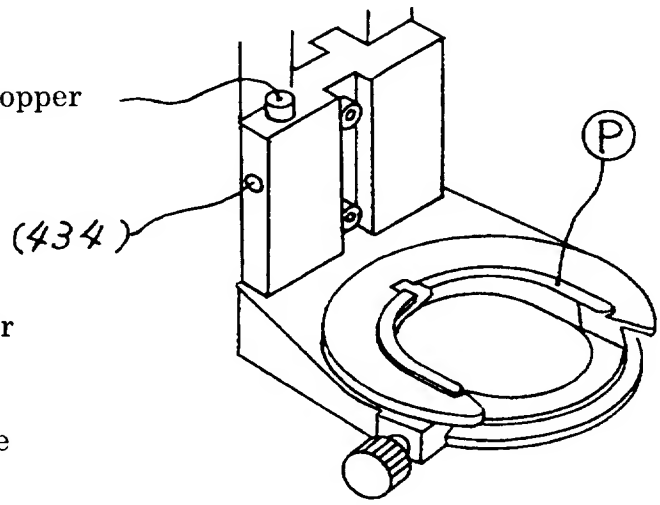
☞ If the top is inserted into D1, the sub-stage is centered within the tolerance.

☞ If not, loosen the set screws (437 x 4) and move the sub-stage.



☞ If the centering rod is inserted into the lower hole D2, the off-center is minimized.

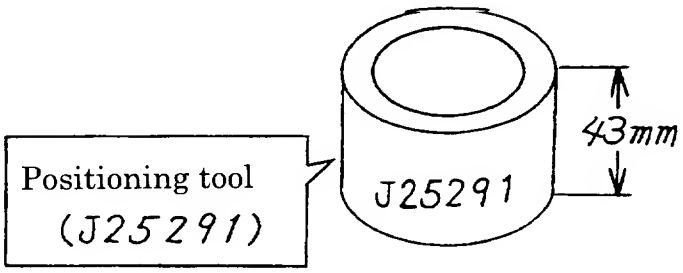
14. POSITIONING OF CONDENSER UPPER LIMIT STOPPER

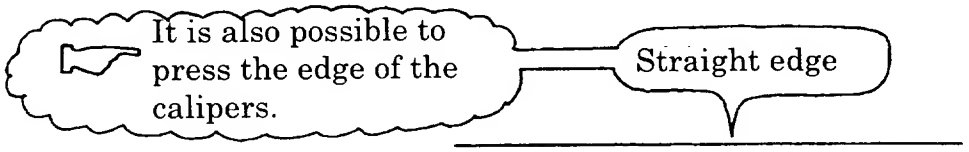


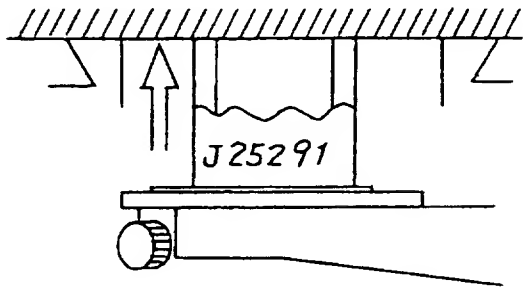
① Loosen the set screw (434) of the upper limit stopper.

☞ The stopper is pushed up by the coil spring below the stopper.

② Place the positioning tool on the top surface Ⓟ (shown above) of the condenser mount.







③ Apply the straight edge to the top surface of the round dovetail of the sub-stage.

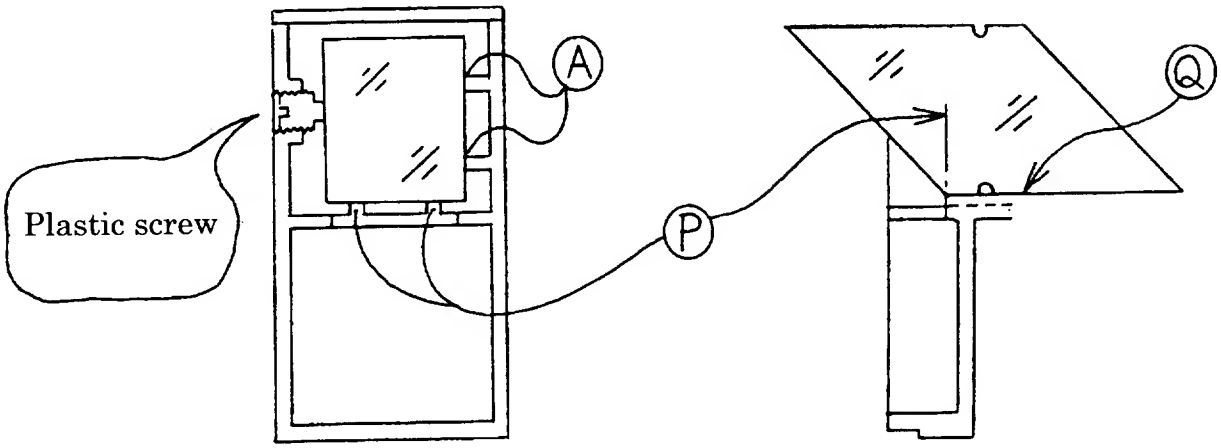
④ Move up the mount with the condenser up-down handle.

Tighten the set screw (434) loosened in ① at the position where the top surface of J25291 is brought into contact with the straight edge.

15-1. PRISM INSTALLATION STANDARD

◎ Assemble the right and left prism boxes to the center axis, then assemble the prisms.

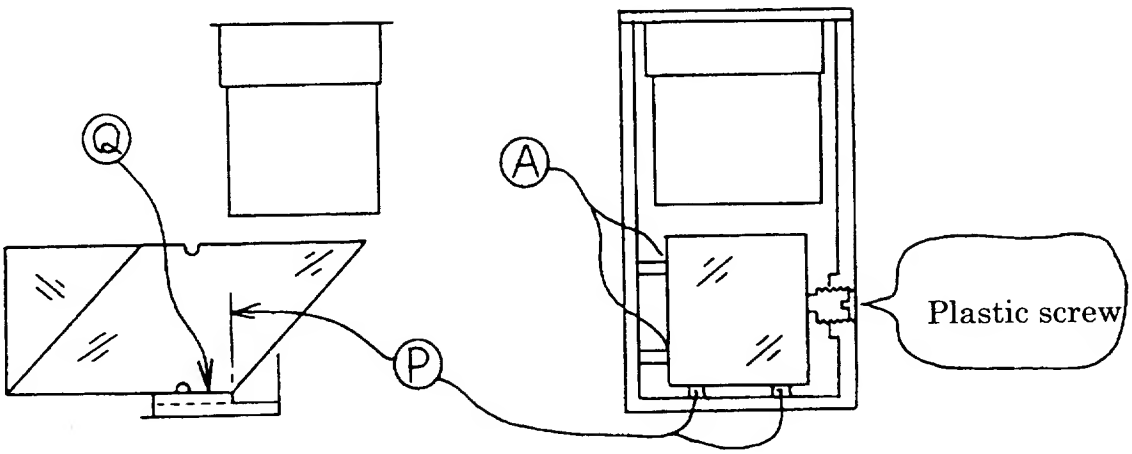
Left prism (Lozenge-shaped)



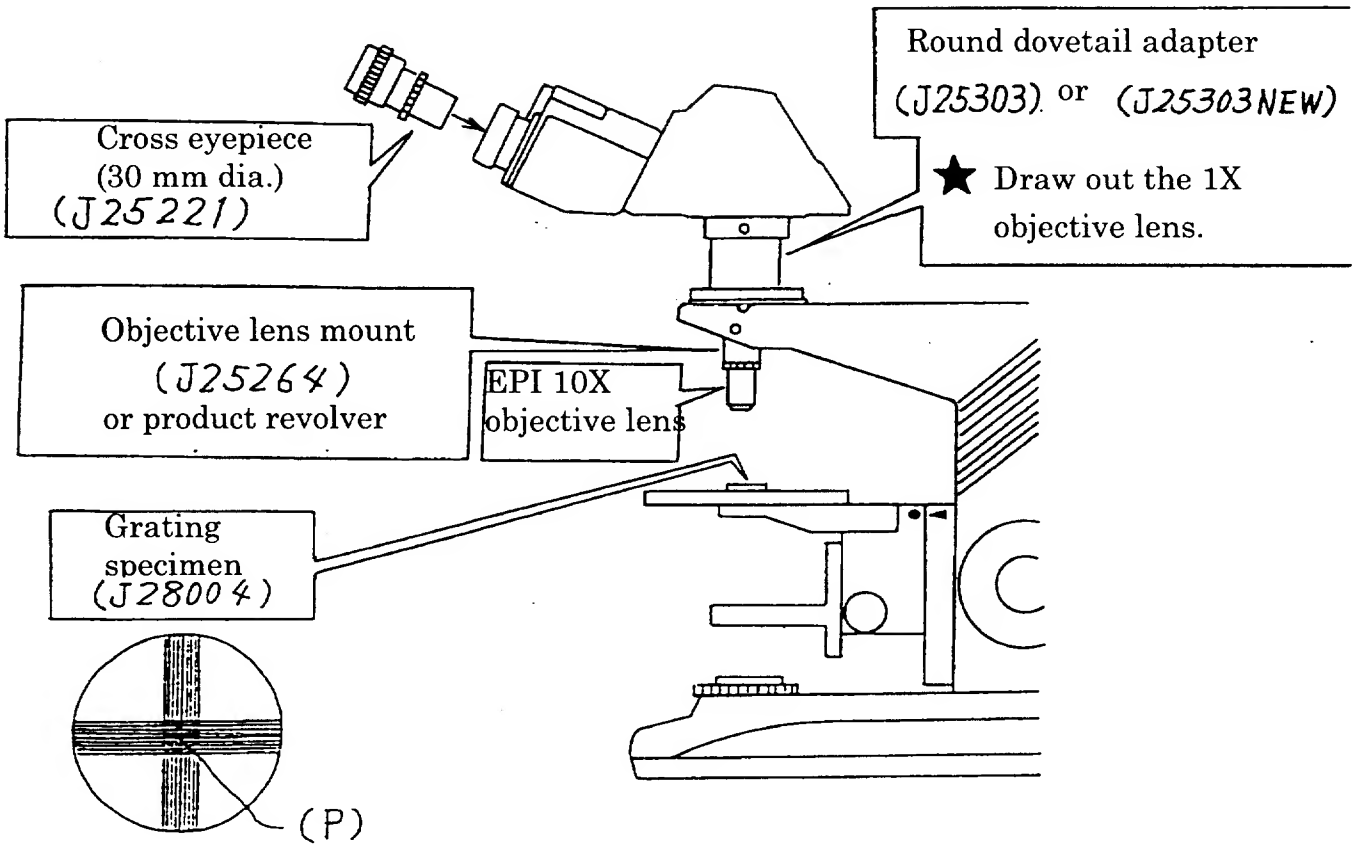
Align the edge of the prism to the end face Ⓟ of the prism box rail. Tighten the plastic screw with care not to make the prism rise from the rail surface Ⓠ.

★ On completion of the adjustments shown in Sections 15-2 (on page 36) and 16-B (on page 51), apply adhesive (#649) to the border Ⓐ between the prism side surface and box.

Right prism (Trapezoidal)



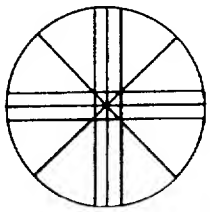
15-2. TILT OF RIGHT PRISM (TRAPEZOIDAL PRISM)



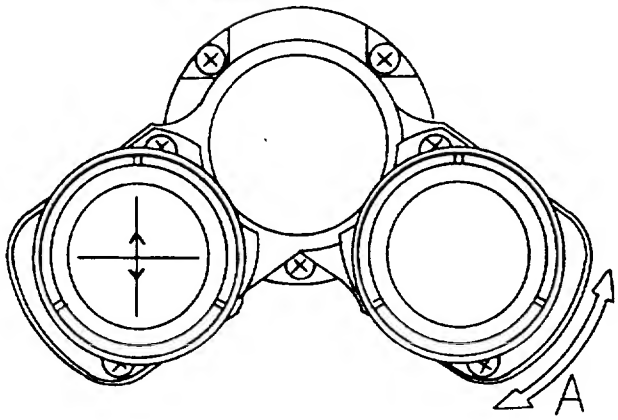
① Set the tool, etc. on the microscope body.

Caution ★ Insert the cross eyepiece into the left eyepiece sleeve.

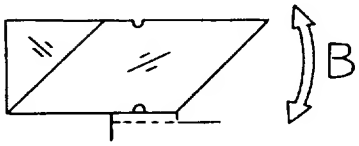
② Move the stage and adjust the center of the grating specimen to the center of the eyepiece.



③ Hold the left eyepiece with a hand to prevent it from moving, and open and close the right eyepiece in the direction of A as shown on the right.

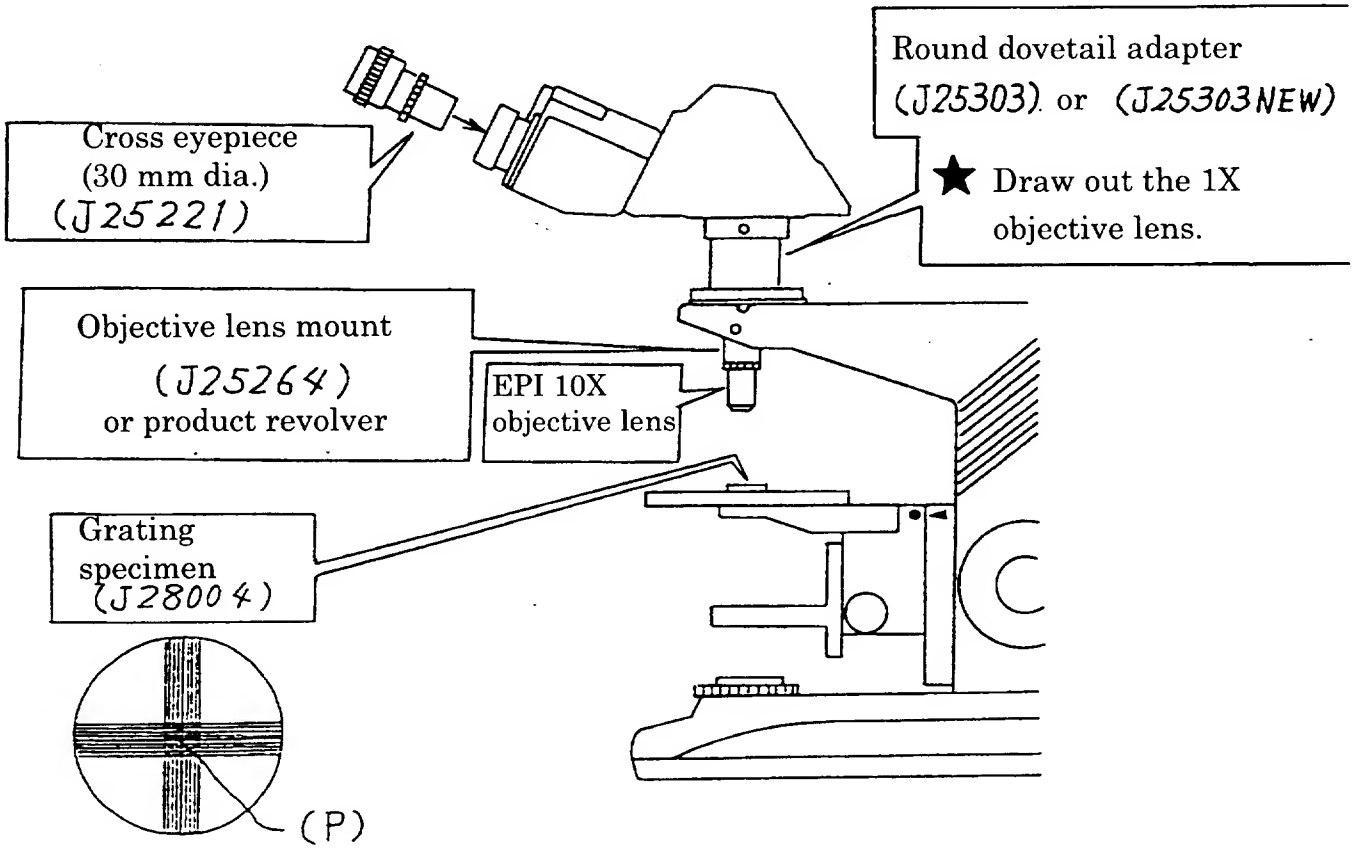


If the center of the grating specimen moves up and down around the eyepiece cross center, tilt the trapezoidal prism in the direction of B to correct the tilt.



★ On completion of adjustment, apply adhesive (#649) to the portion Ⓐ shown on the previous page.

15-3. SHIFT OF OPTICAL AXIS FROM SWING AXIS

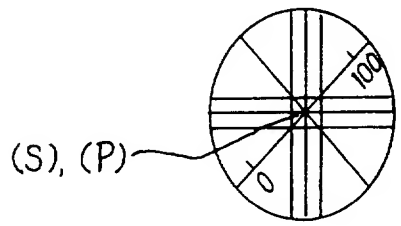


① Set the tool, etc. on the microscope body.

★ Insert the cross eyepiece into the right eyepiece sleeve.

② Adjust the center of the grating specimen (P) to the center of the eyepiece scale (S).

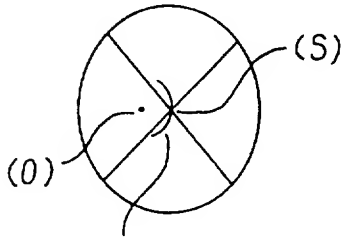
③ Open and close the pupil distance of the right and left eyepieces to check the movement of (P) with respect to (S).



☞ If (P) is always aligned with (S), no adjustment is needed. Advance to step ⑥.

☞ If the optical axis of the right eyepiece is not adjusted to the center of the swing axis, (P) seems to move along the arc whose radius is identical to the shift.

The center of the arc (O) corresponds to the center of the swing axis and seems to stand still on the grating specimen.

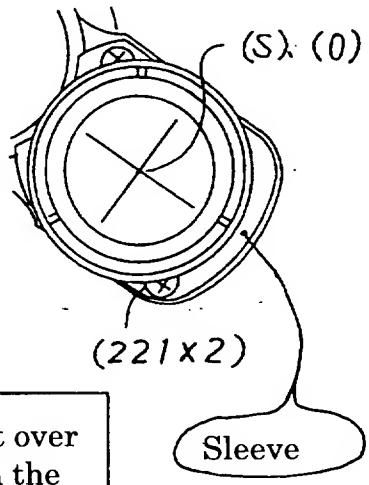


Trace of (P)

★ Stared and remember the position of (O).

15-3. SHIFT OF OPTICAL AXIS FROM SWING AXIS

④ Loosen the sleeve clamp screws (221 x 2).
Move the right sleeve and adjust the eyepiece center (S) to (O)



☞ If the trinocular eyepiece tube (F/T) is used, dismount the cover, loosen the clamp screws (245 x 3), then move the sleeve.

★ If it is necessary to move the sleeve by an amount over the effective range of the wire belt tension, loosen the belt clamp screw.

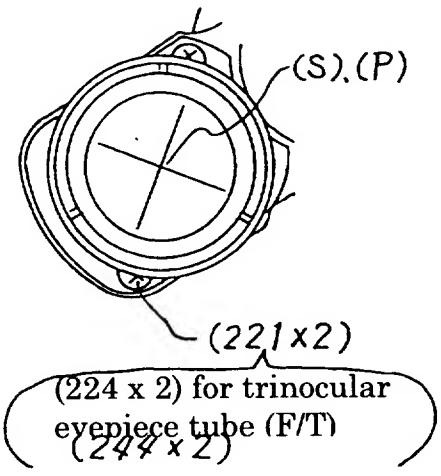
⑤ Move the stage and adjust the center of the grating specimen (P) to the eyepiece cross center (S).

★ Repeat steps ③ to ⑤ and adjust the sleeve position in order to minimize the movement of (P) with respect to (S) when opening and closing the eyepiece.

It may be difficult to eliminate the movement completely. However, remember in what manner (P) moves.

⑥ Make sure that the center of the grating specimen (P) is aligned with the eyepiece cross center (S).
Draw out the cross eyepiece from the right sleeve, and insert it into the left sleeve.
Loosen the left sleeve clamp screws (221 x 2).

Move the sleeve and adjust the eyepiece center (S) to the center of the grating specimen (P).



15-3. SHIFT OF OPTICAL AXIS FROM SWING AXIS

⑦ Adjust the position of the left eyepiece sleeve in the same manner as ③ to ⑤.

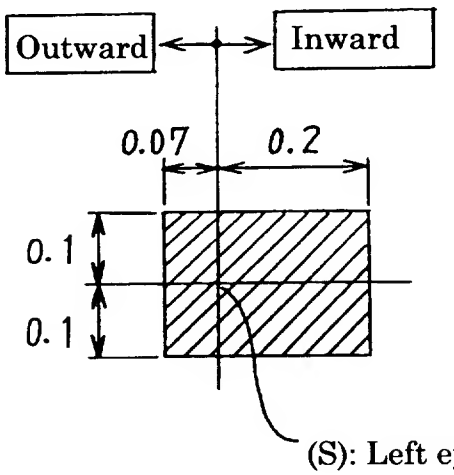
If it is impossible to eliminate the movement of (P) with respect to (S) completely, make it as similar to the movement adjusted in ⑤ as possible.

★ At any rate, carry out (a) and (b) shown below and make sure that the standard is met.

(a) Adjust the center of the grating specimen to the cross center of the eyepiece inserted into the right sleeve.

(b) Set the eyepiece in the left sleeve, and check the center position of the grating specimen with respect to the eyepiece cross center.

Standard: The center should be located in the shaded area shown below.



(Unit: mm)

Eyepiece scale:
0.1 mm/div.

15-4. NEW PARALLEL COLLIMATOR

◎ The new type parallel collimator (J28173) is used for the adjustments described in Sections 15-5 and 15-6.

☞ This collimator has already been introduced in the repair manual of the infinite optical system tube (R-4361.A).

Why New Type Parallel Collimator (J28173) Is Used?

Two types of parallel collimators have been used. These two collimators have fixed angles of depression.

J25133: 30°

J25134: 45°

The eyepiece tubes used recently have different angles of depression as shown below according to the eyepiece height.Accordingly,J25133 and J25134 are not enough for djustments of these tubes.

Eyepiece tubes referred to in this repair manual: 25°

E800 and OPTIPHOTO 300: 20°

TMD300/200: 35°

The angle of depression of the new type parallel collimator (J28173) can be freely adjusted.

Configuration

See the following page.

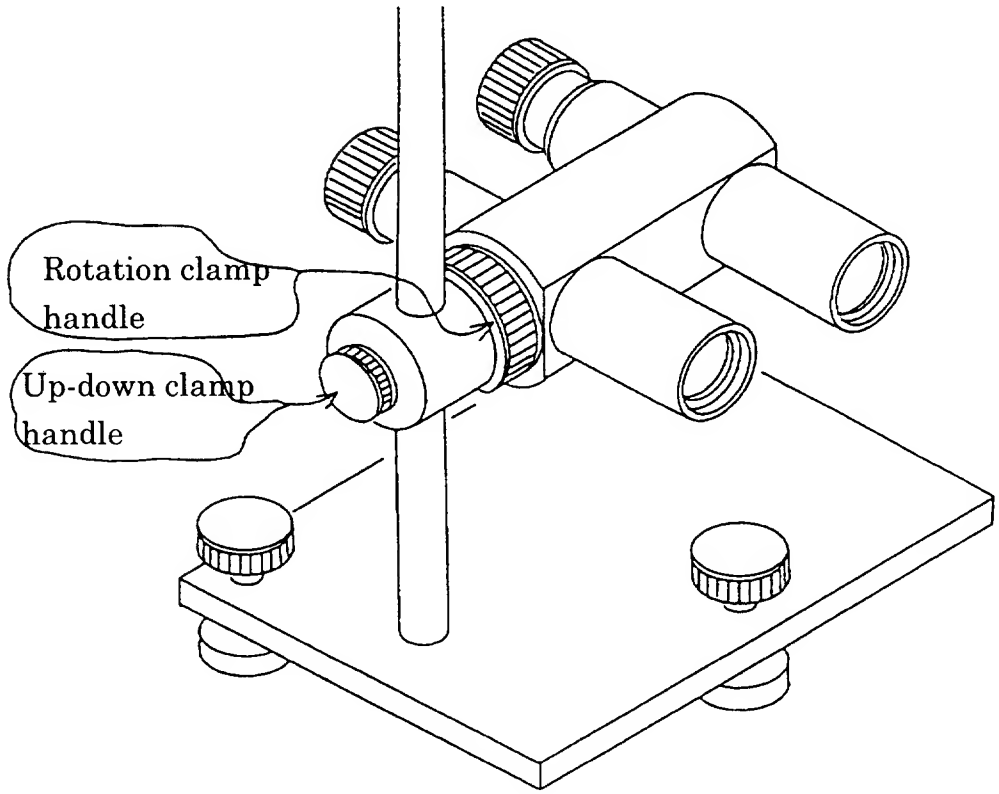
J28173 — J38173A, J28173B, J28173C

How to modify the parallel collimator currently in use

Purchase only the collimator holder unit (J28173B) of the new type parallel collimator (J28173) and replace the holder of the parallel collimator currently in use (J25133 or J25134) with the new collimator holder.
This modification allows the angle of depression of the parallel collimator currently in use to be adjusted freely.

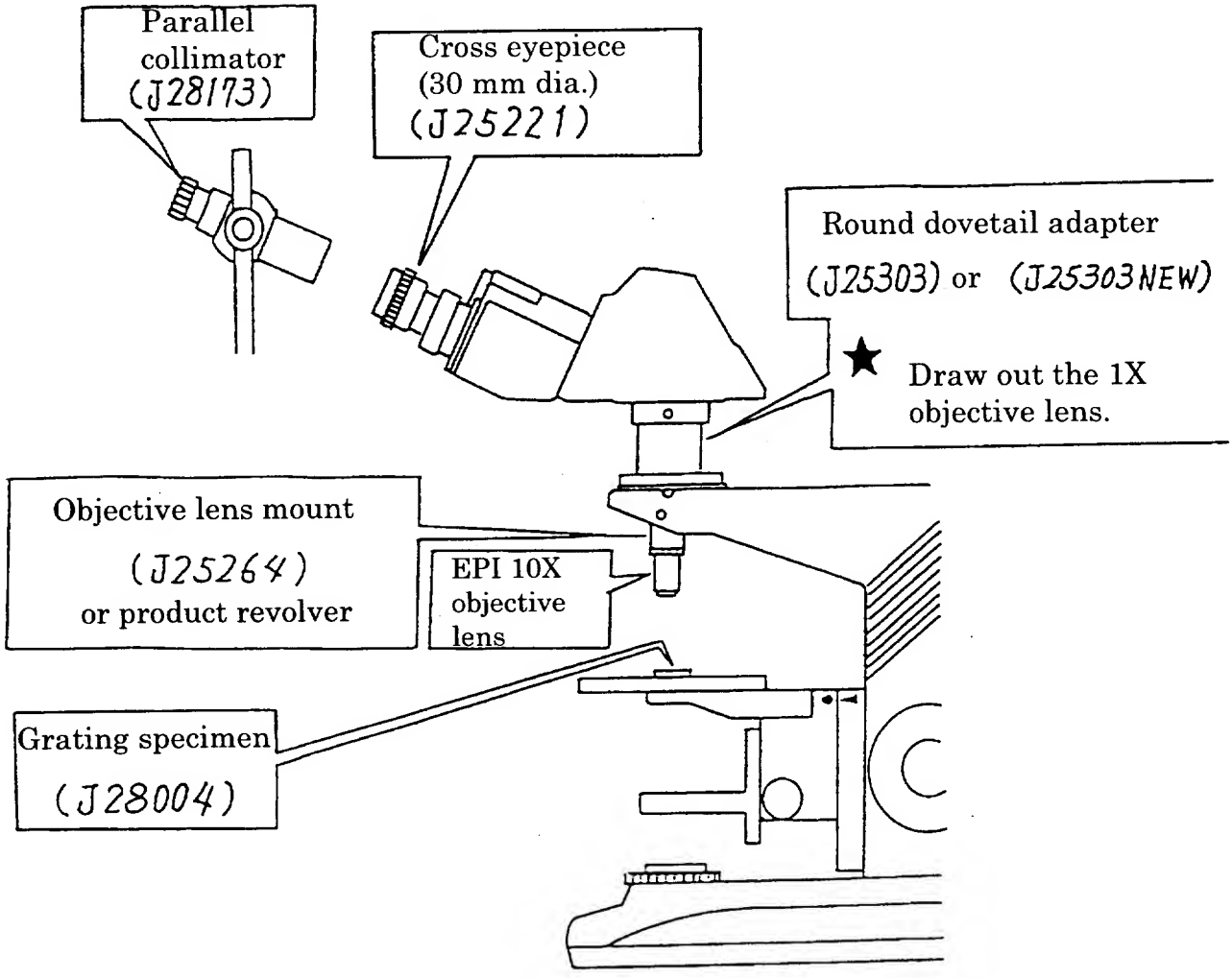
★ After setting the parallel collimator currently in use to J28173B, adjust the parallelism of two collimators.

15-4. NEW PARALLEL COLIMATOR



J28173: Parallel collimator set --- Set of the whole components shown above
J28173A: Collimator unit of J28173 --- Collimator unit of the J28173 set shown above (One collimator only)
J28173C: Stand unit of J28173 --- Only the base and column of the J28173 set shown above
J28173B: Collimator holder unit of J28173 --- J28173 set not including J28173A and J28173C

15-5. MEASUREMENT OF RIGHT AND LEFT EYEPIECE SLEEVE PARALLELISM


Parallel collimator (J28173)
Cross eyepiece (30 mm dia.) (J25221)
Round dovetail adapter (J25303) or (J25303NEW)
★ Draw out the 1X objective lens.
Objective lens mount (J25264) or product revolver
EPI 10X objective lens
Grating specimen (J28004)

① Set the eyepiece tube, objective lens and tool on the microscope body as shown above.

★ Insert the cross eyepiece into the right eyepiece sleeve.

② Rotate the diopter ring of the parallel collimator to adjust the focus on the collimator scale.

③ Rotate the diopter ring of the cross eyepiece to adjust the focus on the cross scale.

④ Move the collimator to adjust the center of the right collimator scale to the center of the cross eyepiece.

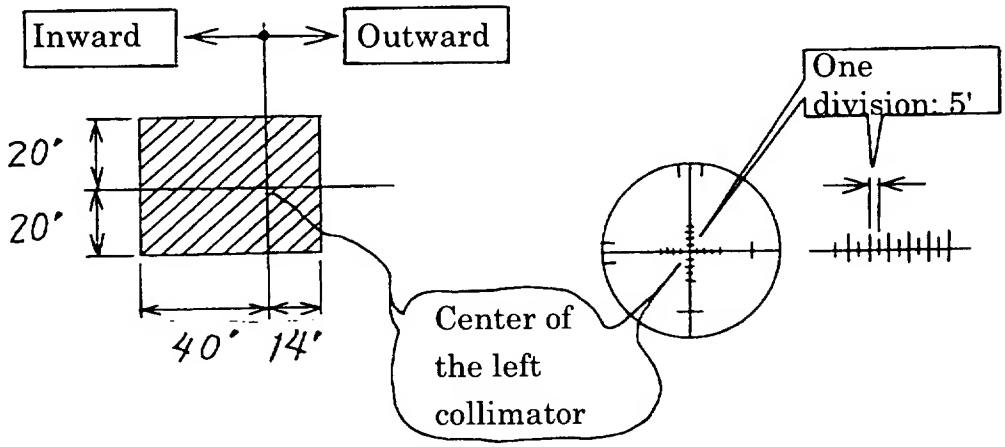
⑤ Remove the cross eyepiece from the right sleeve and insert it into the left sleeve.

★ Be very careful not to rotate the eyepiece.

15-5. MEASUREMENT OF RIGHT AND LEFT EYEPIECE SLEEVE PARALLELISM

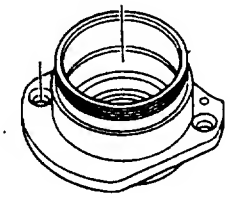
Standard: The center of the cross eyepiece should be located in the shaded area shown below around the collimator scale center.

☞ The Inward and Outward are reverse to those shown in the figure in section 15-3 (on page 39), because the image is rotated by half turn by the collimator.



◎ If the center of the cross eyepiece shifts from the center of the left collimator, it means that the right and left eyepiece sleeves are not in parallel.

☞ If the standard shown above is not met, replace the right or left sleeve.



15-6. TILT OF RIGHT AND LEFT IMAGES

① to ⑤ Carry out the same work as described in steps ① to ⑤ in the previous section.

⑥ Make the horizontal line of the grating specimen in parallel with the horizontal line of the collimator scale.

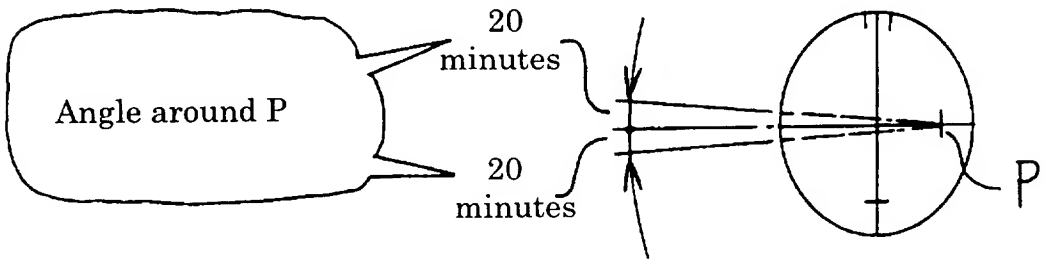
⑦ Remove the eyepiece from the right sleeve and insert it into the left sleeve.

★ Be very careful not to rotate the eyepiece.

⑧ Check whether the horizontal line of the grating specimen is tilted with respect to the horizontal line of the collimator scale.

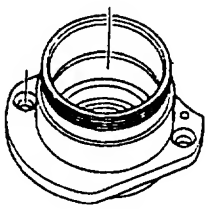
Standard value: 20 minutes or less

Judge the degree of tilt from the pattern of the collimator scale (as shown below).

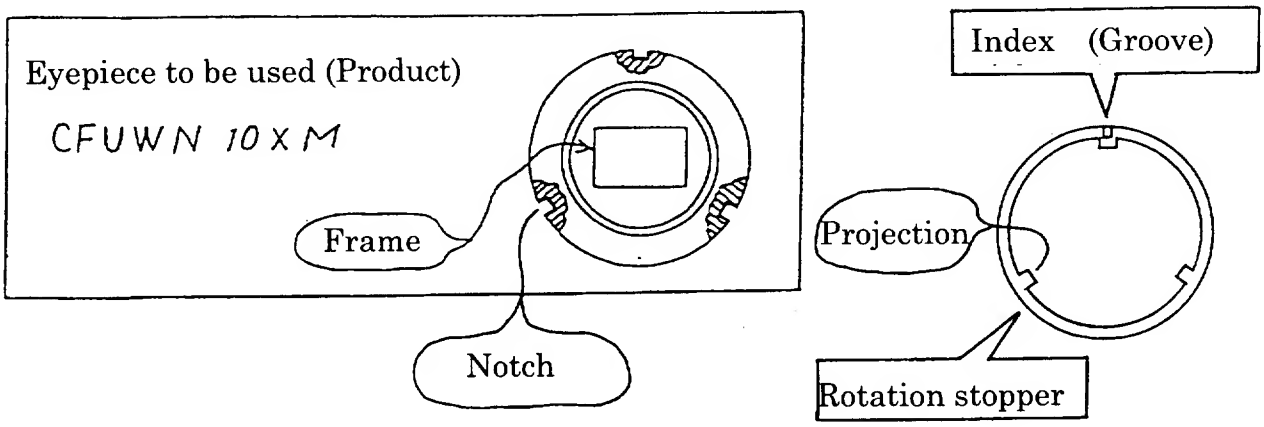


☞ Tilt of the horizontal line of the grating specimen over 20 minutes may possibly be caused by the following:

- ○ Improper processing of the prism
- ○ Deformation of the prism box
- ○ Deformation of the eyepiece sleeve



15-7. ROTATIONAL DIRECTION OF RIGHT EYEPIECE SLEEVE



① Insert the eyepiece into the right sleeve.

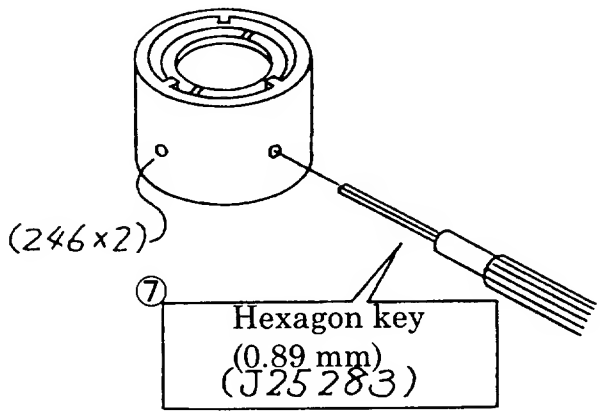
☞ Face the index (groove) of the rotation stopper right upward as shown above, fit the notches in the outer periphery to the projections of the stopper in the position where the horizontal (or vertical) line of the frame in the visual field of the eyepiece is horizontal (or vertical), and insert the eyepiece into the sleeve.

② Look through the right eyepiece, when viewed from the front, with the right eye, and check whether the horizontal (or vertical) line of the frame is horizontal (or vertical).

★	Check the horizontality and verticality by sense. (There is no standard of checking the horizontality and verticality.)

☞ If the frame seems to be tilted, loosen the set screws (246 x 2) on the side of the rotation stopper, and rotate the rotation stopper to correct the tilt.

◎ The method of adjusting the rotational direction of the right eyepiece sleeve using the parallel collimator is shown on the following page, though the above-shown adjustment is enough.



15-7. ROTATIONAL DIRECTION OF RIGHT EYEPIECE SLEEVE

☞ More accurate adjustment

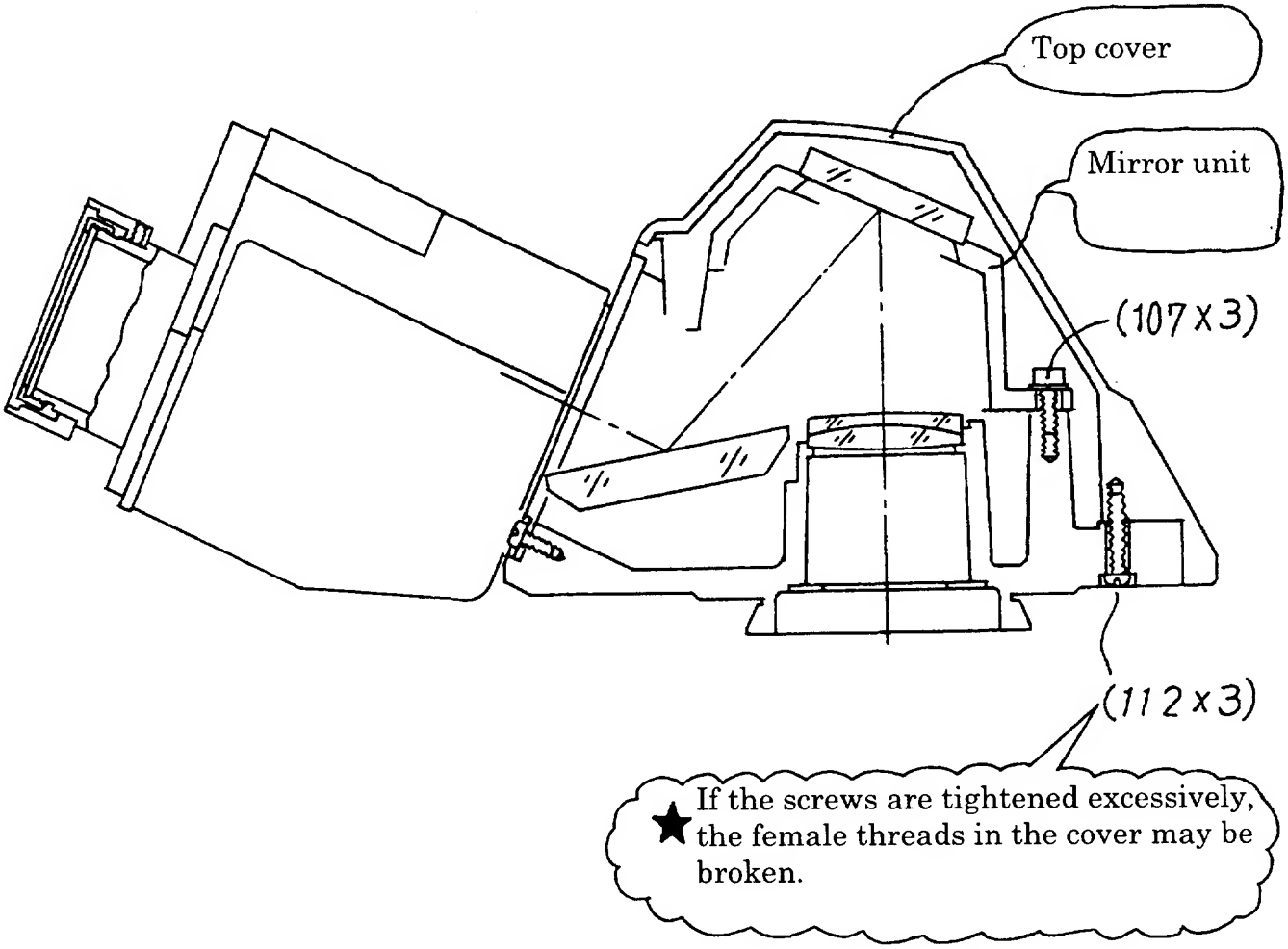
(a) Set the cross eyepiece (J25221) in the right and left sleeves alternately, and adjust the centers of the right and left collimator scale of the parallel collimator to the cross center of the eyepiece.

☞ It is enough to adjust the vertical positions only.

(b) Insert the eyepiece CFUWN10XM into the right sleeve, and rotate the rotation stopper to make the frame parallel with the collimator scale.

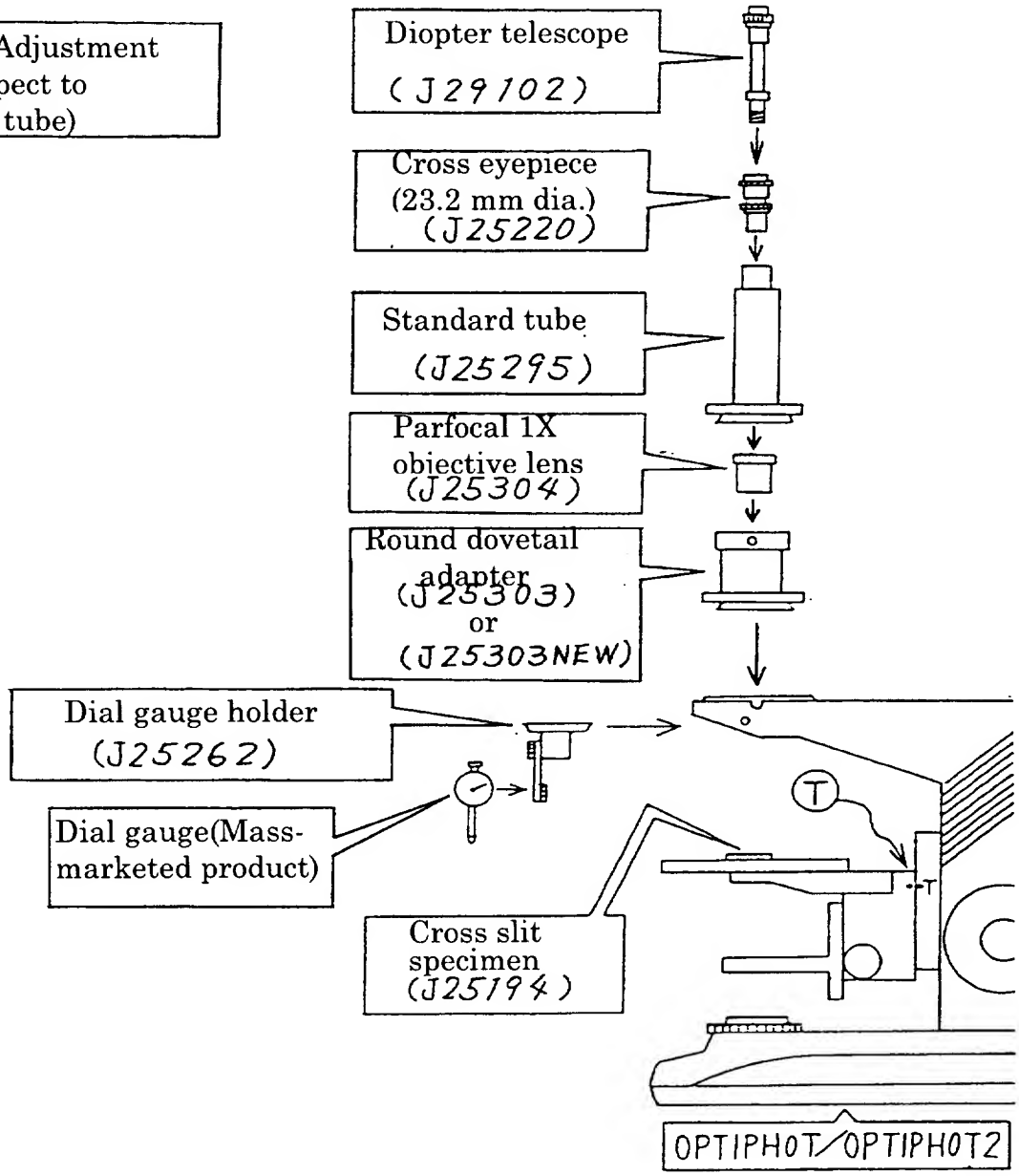
(c) Tighten the rotation stopper set screws (246 x 2).

16. BINOCULAR EYEPIECE TUBE (B) [CROSS SECTIONAL VIEW]



16. ADJUSTMENT OF BINOCULAR EYEPIECE TUBE (B)

A. Parfocal Adjustment (with respect to standard tube)

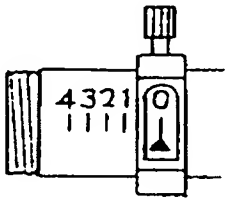


① Set the tools and dial gauge to the microscope body as shown above.

★ Adjust the sub-stage height to the "T" mark (T) in the above figure).

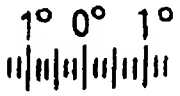
○ Adjust the diopter scale of the diopter telescope to "0".

○ Do not set the cross slit specimen yet.



16. ADJUSTMENT OF BINOCULAR EYEPIECE TUBE (B)

② Rotate the diopter ring of the diopter telescope to adjust the focus to the reticle of the diopter telescope.

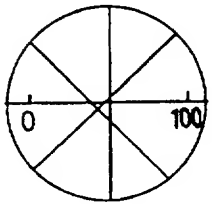


③ Rotate the diopter ring of the cross eyepiece to adjust the focus to the cross scale.

④ Set the cross slit specimen on the stage top surface.
Rotate the coarse focusing handle to adjust the focus to the cross slit.

★ Stop rotating the handle at the point where the blue (or red) color around the slit is about to change into red (or blue).

Remember the condition at the moment when the color changes sensuously.

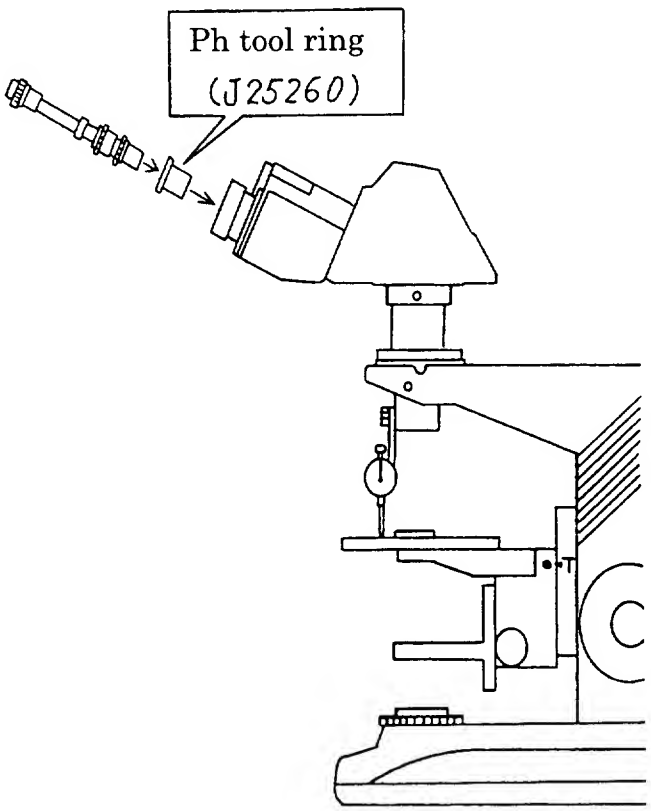


★ Hereinafter, do not touch the diopter ring of either the diopter telescope or cross eyepiece.

⑤ Apply the top of the dial gauge probe to the stage top surface.
Adjust the scale to "0".

⑥ Detach the standard tube.
Attach the eyepiece tube instead.

⑦ Draw out the cross eyepiece together with the diopter telescope from the standard tube.
Insert them into the right eyepiece sleeve through the Ph tool ring.



16. ADJUSTMENT OF BINOCULAR EYEPIECE TUBE (B)

⑧ Rotate the coarse focusing handle to adjust the focus to the slit in the same manner as described in ④ .

★ Stop rotating the handle at the point where the blue (or red) color is about to change into red (or blue).

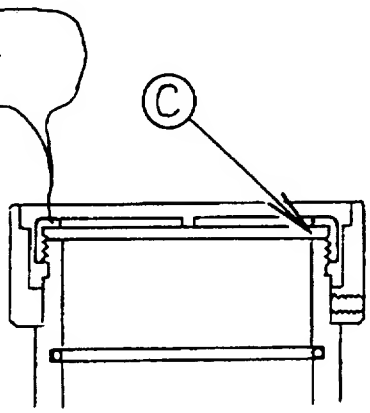
☞ No adjustment is needed if the scale of the dial gauge reads the standard value shown below:

Standard value: 0 ±0.2 mm

☞ If the dial gauge reads an off-standard value, rotate the adjust ring shown below.

Adhesive (#350) is applied to the threads

Adjust ring



★ Apply alcohol to the gap indicated with the arrow Ⓒ with tweezers.
Make it penetrate into the threads to melt the adhesive.

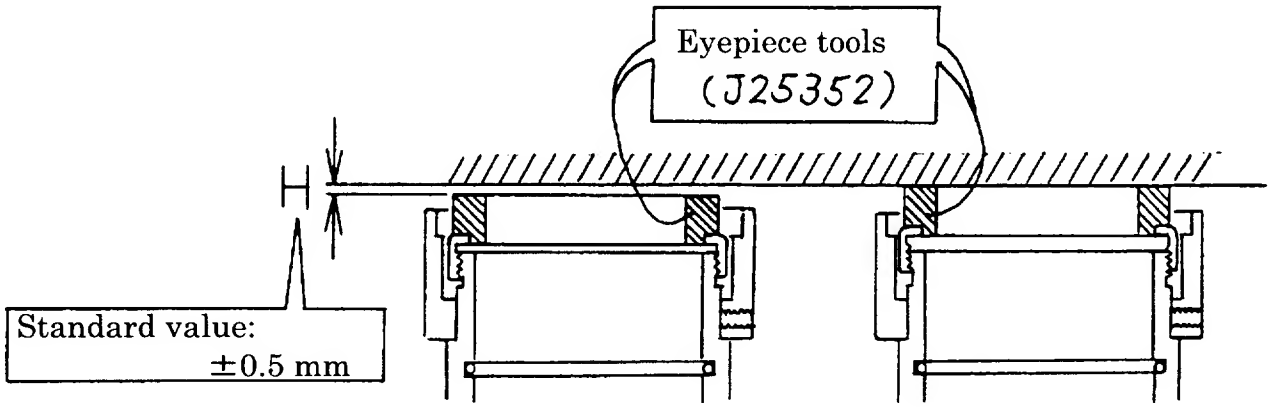
- ○ When the dial gauge reads a positive value, rotate the adjust ring clockwise.
  When it reads a negative value, rotate the ring counterclockwise.
- ○ Standard rotation: 1/5 turn per 0.1 mm

⑨ Remove the eyepiece from the right sleeve and insert it into the left sleeve. Carry out the same adjustment as described in ⑧ .

16. ADJUSTMENT OF BINOCULAR EYEPIECE TUBE (B)

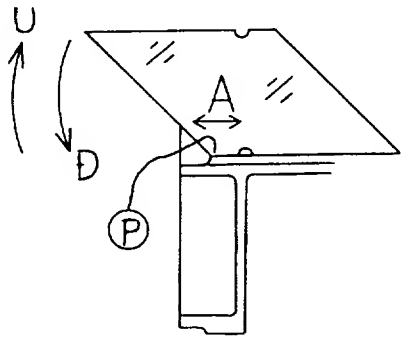
B. Height Difference Adjustment of Eyepiece Sleeves

⑩ Insert the eyepiece tools (J25352) into the adjust ring as shown below. Apply the straight edge to the top surface of the tools to check the height difference (H).



☞ If the value of H is not up to standard, detach the left cover,tilt the lozenge-shaped prism to change the optical path length, and adjust the height of the left adjust ring.

◎ If the left adjust ring is too low as shown above, tilt the lozenge-shaped prism in the direction of the arrow D as shown on the right.



If the left adjust ring is too high, tilt the prism in the direction of the arrow U.

★ Be careful not to shift the prism in the direction of the arrow A.
-- In order not to separate the edge of the prism from the rail end Ⓟ --

If the edge of the prism is separated from the rail end Ⓟ , it is necessary to adjust the optical axis of the left eyepiece as shown in Section 15-3 (on page 39).

☞ Once the prism is tilted, check whether the parfocality of the left eyepiece meets the standard again.

16. ADJUSTMENT OF BINOCULAR EYEPIECE TUBE (B)

C. Optical Axis Adjustment

◎ The optical axis can be adjusted in two ways: Using the optical axis standard objective (J28171), and without using it.

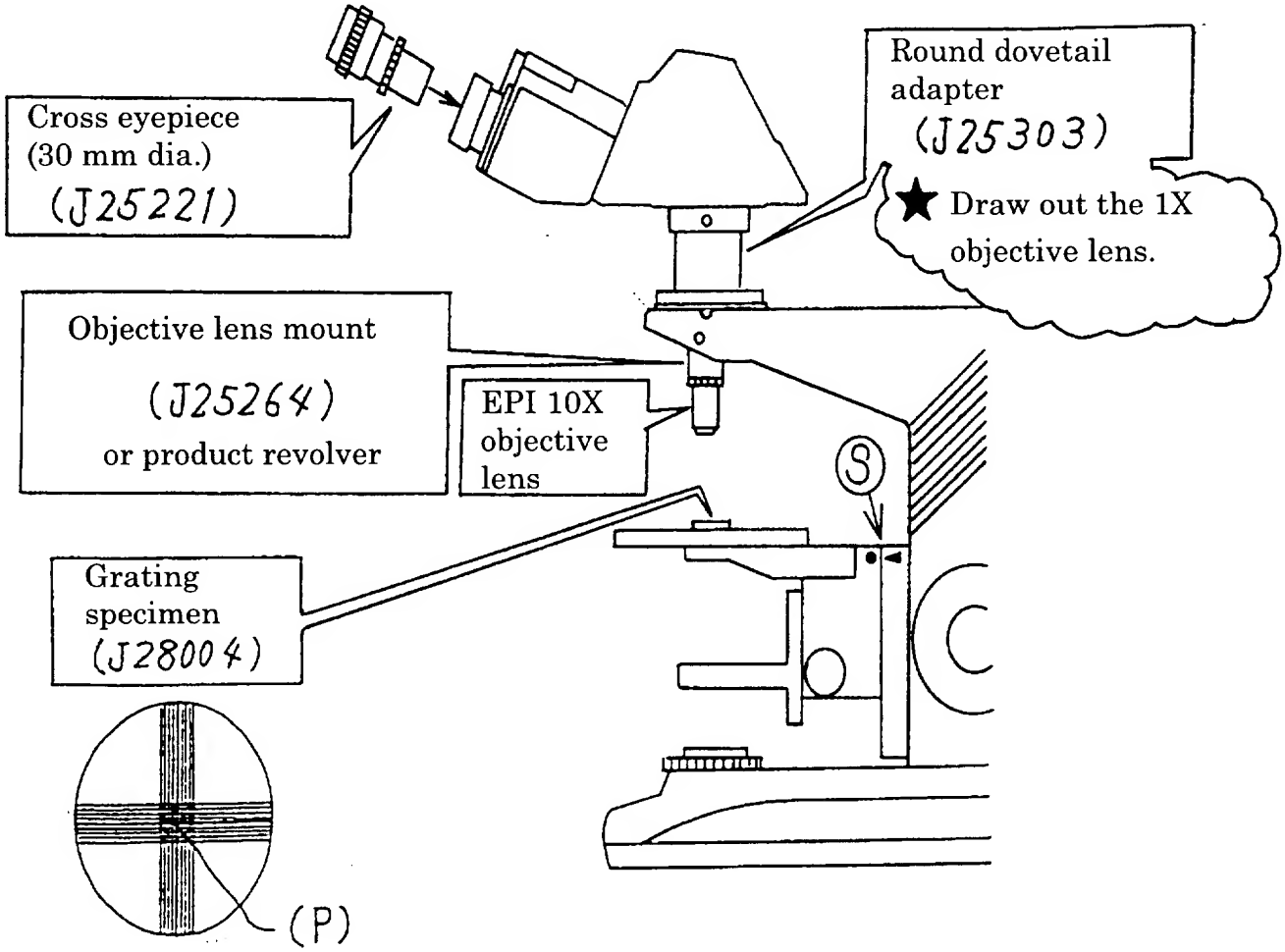
☞ For details, refer to Section 5-3-5 in the repair manual of the infinite optical system tube (R-4361) already issued.

The repair manual R-4361 describes the optical axis adjustment method using J28171.
This repair manual describes how to adjust the optical axis without using J28171.

◎ Any type of objective lens can be used, provided it is designed for the infinite optical system. However, the OPTIPHOT or OPTIPHOT2 accepts the round dovetail type revolver only. Thus, it is recommended to use the EPI 10X having the standard threads (D = 20.32, 1/P = 36).

◎ There are no problems if a revolver obtainable on the market is used. The descriptions below, however, assume that the tool objective lens mount (J25264) is used.

16. ADJUSTMENT OF BINOCULAR EYEPIECE TUBE (B)

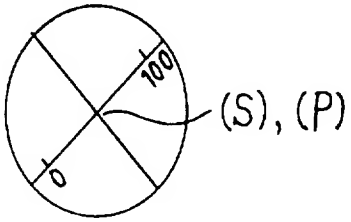


⑪ Set the tools on the microscope body as shown above.

- ○ Remember to draw out the 1X objective lens from the round dovetail adapter.
- ○ Return the sub-stage to the standard height position.
  -- Point Ⓢ shown in the figure above
- ○ The figure above shows the adjustment tools using the 30 mm dia. cross eyepiece J25221. However, the 23.2 mm dia. eyepiece having been used till now will do, as a matter of course.

★ Insert the eyepiece into the right sleeve.

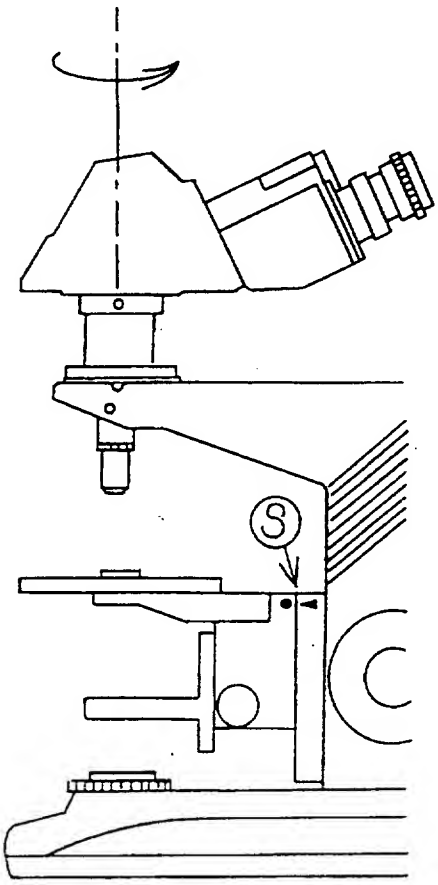
⑫ Move the stage and adjust the center of the grating specimen (P) to the cross center of the eyepiece (S).



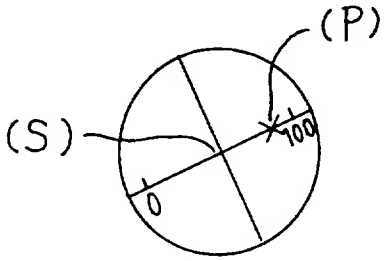
16. ADJUSTMENT OF BINOCULAR EYEPIECE TUBE (B)

⑬ Rotate the eyepiece tube in the round dovetail adapter by half turn (as shown on the right).

Check the shift of the grating specimen center (P) from the cross center of the eyepiece (S).



Rotate the eyepiece in the sleeve and align the scale line with (P) as shown below.
By this, the shift can be measured easily.

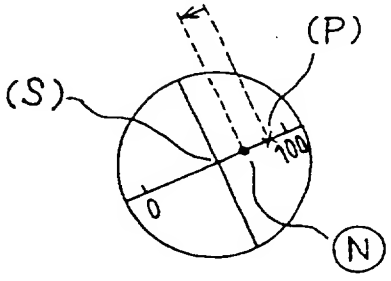


Standard value: 0.2 mm or less (Two divisions on the eyepiece scale)

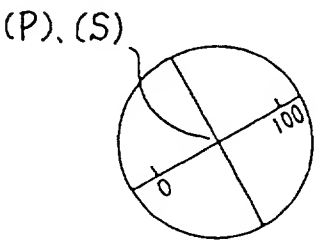
If the shift is below the standard value, no adjustment is needed.

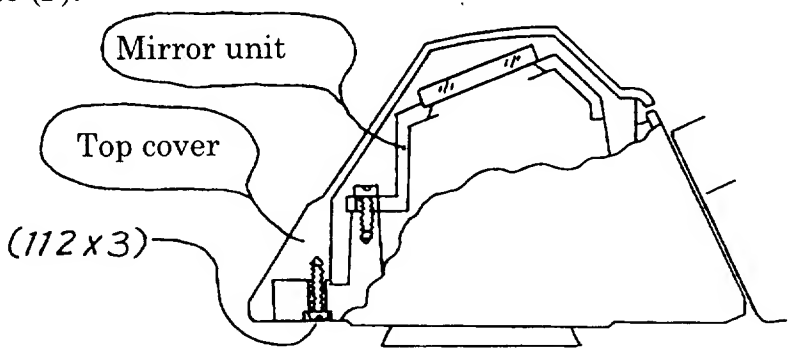
If it exceeds the standard value, proceed to step ⑭.

⑭ Move the stage to move the grating specimen center (P) to the center Ⓝ between (P) and (S).



⑮ Remove the screws (112 x 3) from the bottom, detach the top cover, and move the mirror unit to adjust the cross center of the eyepiece (S) to (P).

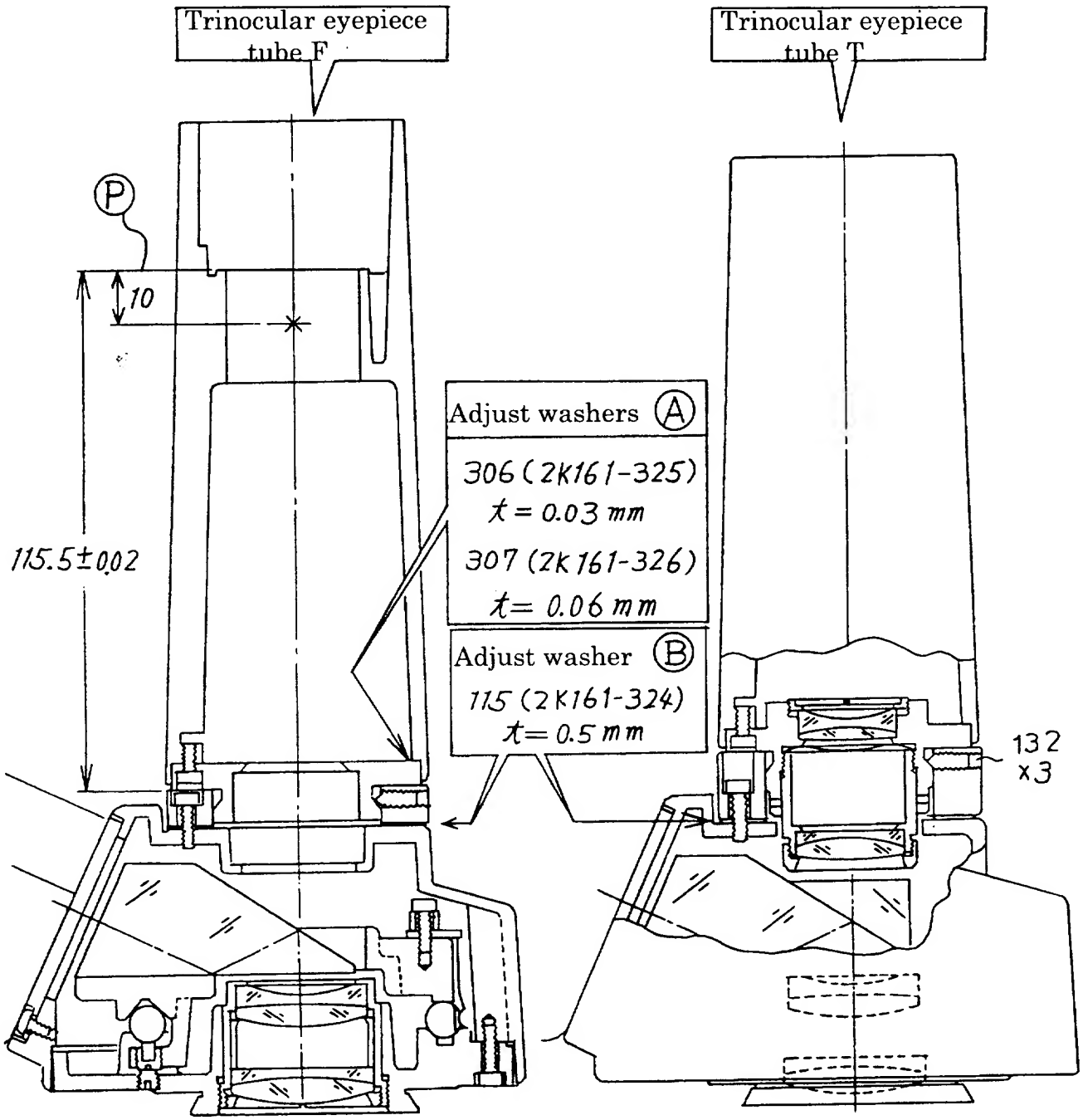




Rotate the eyepiece tube in the round dovetail adapter by half turn, and check whether the shift of (P) from (S) is below the standard value shown in ⑬. Repeat steps ⑬ to ⑮.

17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE(F/T)

[CROSS SECTIONAL VIEW AND OUTLINE OF PARFOCAL ADJUSTMENT]



Outline of Parfocal Adjustment (Specification Concept)

First, move in or out the lens cell at the bottom of the eyepiece tube to adjust the parfocality of the photo tube (with respect to the standard tube J25295). Then, detach the binocular unit, attach the tool tube (J25349) instead of the binocular unit, and check the parfocal accuracy. If the parfocality does not meet the standard (i.e., ±0.7 mm), increase or decrease the adjust washers Ⓑ, then retry adjustment from the beginning.

17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE(F/T)

Adjustment of Photo Tube Length

◎ Eyepiece Tube (F)

☞ Adjust the dimension between the tube bottom and the surface Ⓟ to 115.5 ±0.02 mm using the adjust washers Ⓐ shown above.

★ This dimension has been adjusted properly before shipment. Therefore, no adjustment is needed unless the adjust washers are changed.

◎ Eyepiece Tube (T)

☞ Use the photo tube of the eyepiece tube (F) and carry out adjustment as shown in (a) to (e) below.

(a) Loosen the set screws (132 x 3) on the side. Detach the photo tube from the eyepiece tube (T).

(b) Detach the photo tube from the eyepiece tube (F), and attach it to the eyepiece tube (T).

(c) Move in or out the lens cell at the bottom of the eyepiece tube (T) to adjust the parfocality of the photo tube (with respect to the standard tube J25295).

★ Do not apply adhesive (#350) to the lens cell until the parfocal adjustment (shown on page 61) is completed.

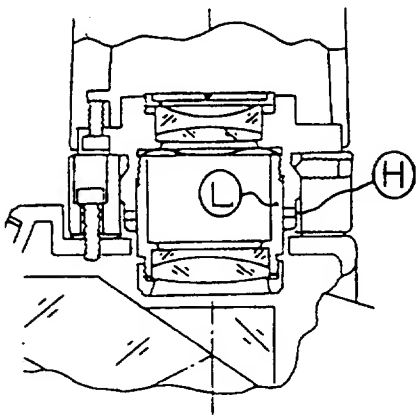
(d) Reset the photo tubes into the corresponding eyepiece tubes.

(e) Move in or out the lens cell Ⓛ below the photo tube of the eyepiece tube (T) to adjust the parfocality (with respect to the standard tube J25295).

☞ Make alcohol penetrate into the tool hole Ⓗ to melt the adhesive (#350), then rotate the lens cell.

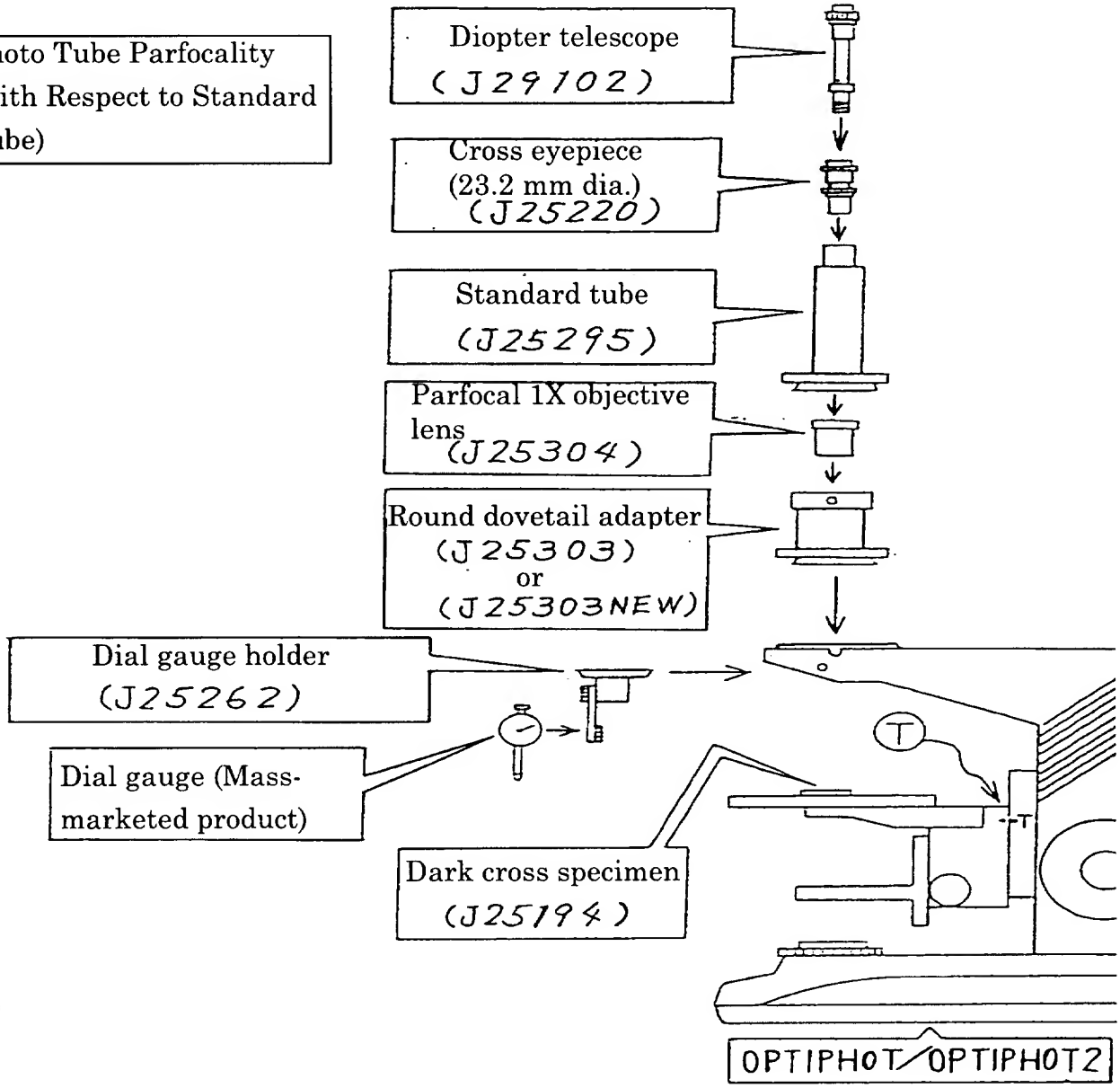
★ After completion of adjustment, remember to pour adhesive into the tool hole.

★ Do not rotate the lens cell unnecessarily.



17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE (F/T)

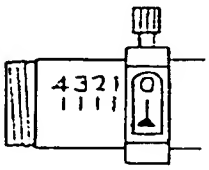
A. Photo Tube Parfocality (with Respect to Standard Tube)



① Set the tools and dial gauge to the microscope body as shown above.

★ Adjust the sub-stage to the "T" mark (Ⓣ in the above figure).

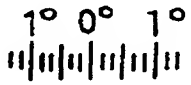
○ Adjust the diopter scale of the diopter telescope to "0".



○ Do not set the cross slit specimen yet.

17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE (F/T)

② Rotate the diopter ring of the diopter telescope to adjust the focus to the reticle of the diopter telescope.

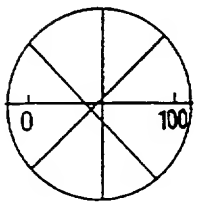


③ Rotate the diopter ring of the cross eyepiece to adjust the focus to the cross scale.

④ Set the cross slit specimen on the stage top surface.
Rotate the coarse focusing handle to adjust the focus to the cross slit.

★ Stop rotating the handle at the point where the blue (or red) color around the slit is about to change into red (or blue).

Remember the condition at the moment when the color changes sensuously.

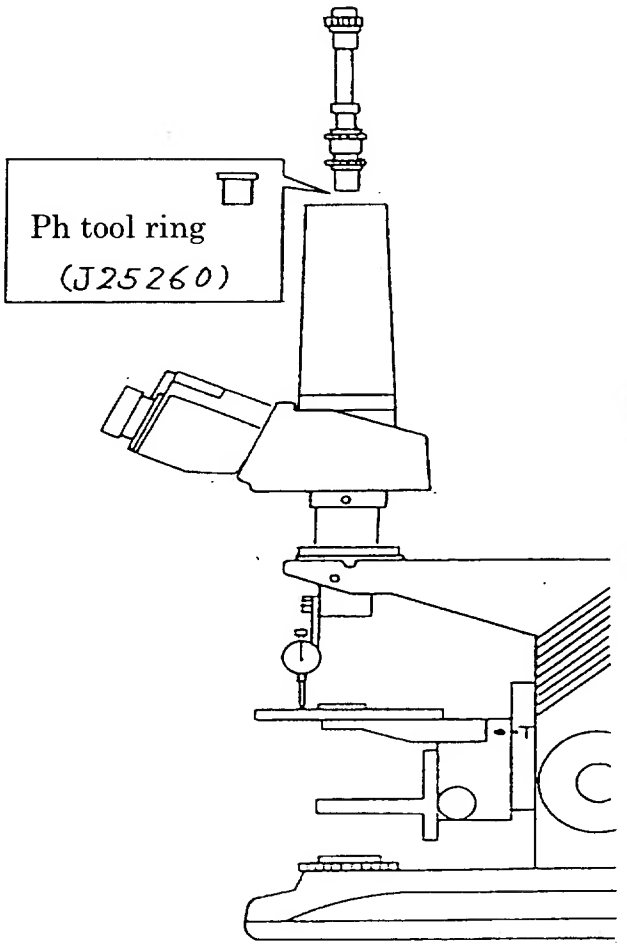


★ Hereinafter, do not touch the diopter ring of either the diopter telescope or cross eyepiece.

⑤ Apply the top of the dial gauge probe to the stage surface. Adjust the scale to "0".

⑥ Detach the standard tube. Attach the eyepiece tube instead.

⑦ Draw out the cross eyepiece together with the diopter telescope from the standard tube. Insert them into the photo tube through the Ph tool ring.



17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE (F/T)

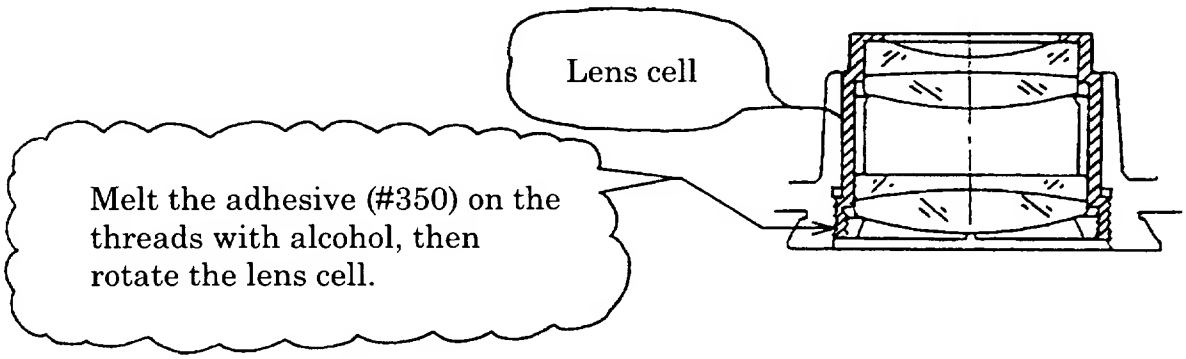
⑧ Rotate the coarse focusing handle to adjust the focus to the slit in the same manner as described in ④.

★ Stop rotating the handle at the point where the blue (or red) color is about to change into red (or blue).

☞ No adjustment is needed if the scale of the dial gauge reads the standard value shown below:

Standard value: 0 ±0.2 mm

☞ If the dial gauge reads an off-standard value, rotate the lens cell on the bottom as shown below.



- ○ When the dial gauge reads a positive value, rotate the lens cell clockwise. When it reads a negative value, rotate the lens cell counterclockwise.
- ○ Standard rotation: 1/5 turn per 0.1 mm

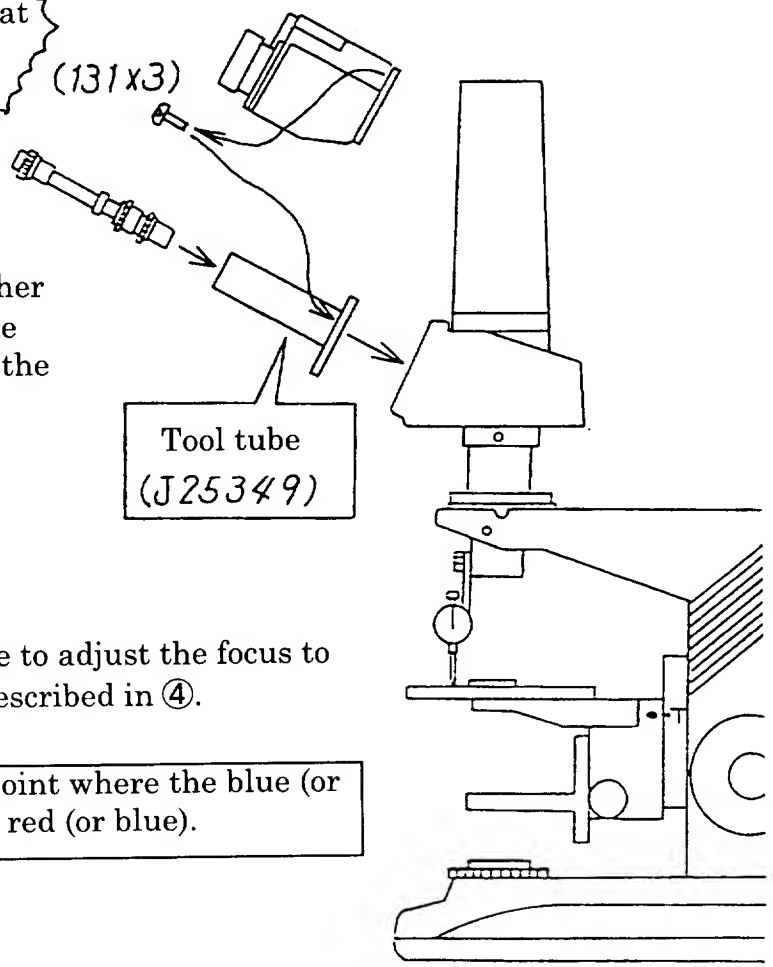
★★★ After completion of the adjustment shown in step ⑫, make adhesive (#350) penetrate into the threads of the lens cell.

17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE (F/T)

B. Parfocal Adjustment of Binocular Unit Tool Tube

⑨ Remove the binocular unit from the eyepiece tube. Attach the tool tube instead of it.

★ Attach the tool tube so that the screws (131 x 3) are located in the center of three holes in the tool tube.



⑩ Draw out the cross eyepiece together with the diopter telescope from the photo tube, then insert them into the tool tube.

⑪ Adjust the dial gauge scale to "0".

⑫ Rotate the coarse focusing handle to adjust the focus to the slit in the same manner as described in ④.

★ Stop rotating the handle at the point where the blue (or red) color is about to change into red (or blue).

☞ No adjustment is needed if the scale of the dial gauge reads the standard value shown below:

Standard value: 0 ±0.7 mm

☞ If the dial gauge reads an off-standard value, carry out adjustment as shown below.

17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE (F/T)

If the dial gauge reads a value over +0.7 mm

(a) Add adjust washer Ⓑ (t = 0.5 mm) under the photo tube holder. (See page 55.)

★ The dial gauge reading decreases by the thickness of the added washer.

When the dial gauge reads [+0.9 mm], for example, add two washers. (The total thickness of two washers is 1.0 mm.) Now, the dial gauge reads the following value at the next (b).

$+0.9 - 1.0 = -0.1$ (mm)

Adjustment is completed.

(b) Repeat steps ① to ⑫.
If the dial gauge reading meets the standard of 0 ±0.7 mm in step ⑫ , adjustment is completed.

If the dial gauge reads a value less than -0.7 mm

(a) Remove adjust washer(s) Ⓑ (t = 0.5 mm) from under the photo tube holder. (See page 55.)

★ The dial gauge reading increases by the thickness of the removed washer(s).

When the dial gauge reads [−0.8 mm], for example, remove one washer. (The thickness of one washer is 0.5 mm.)
Now, the dial gauge reads the following value at the next (b).

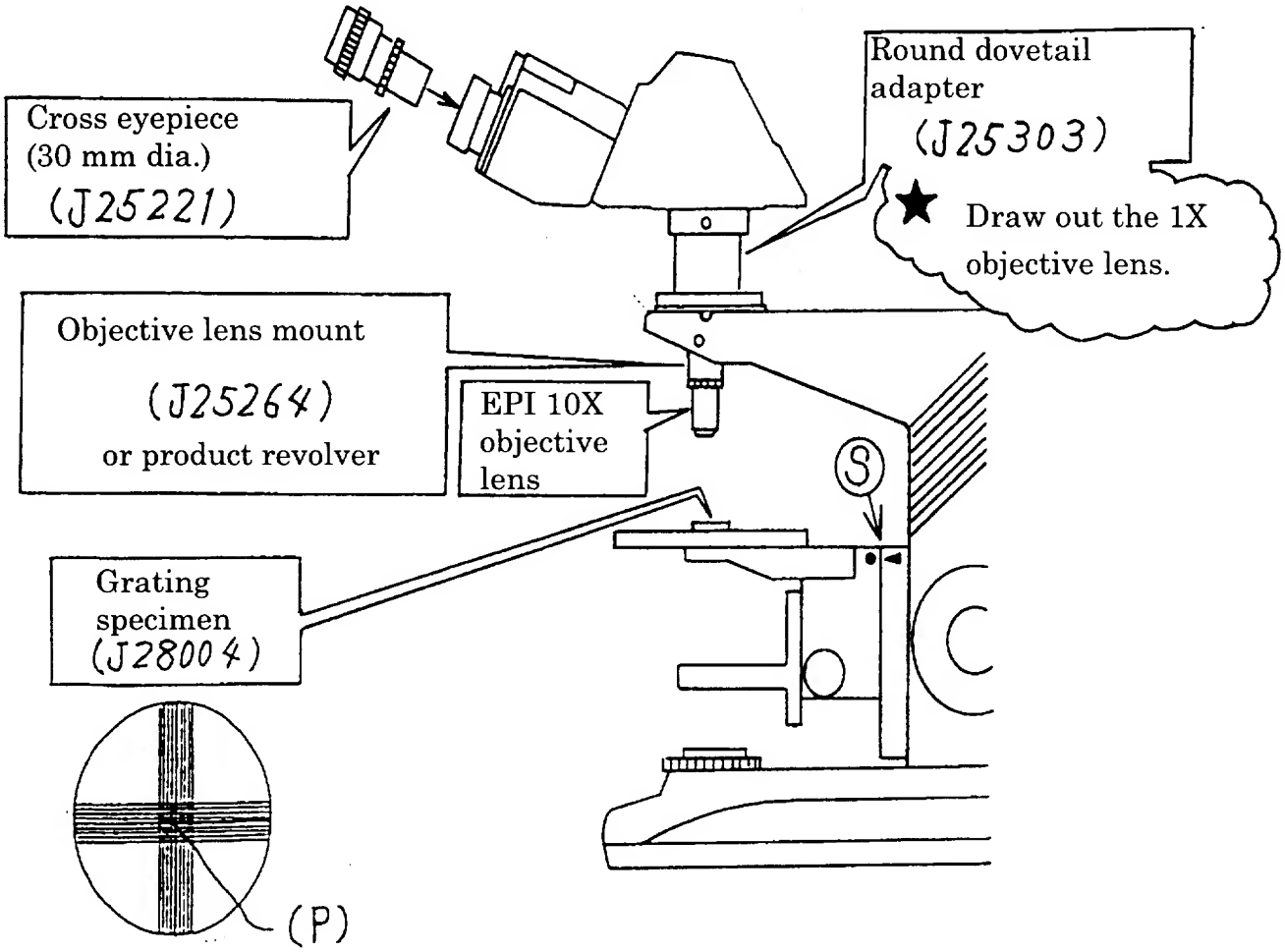
$-0.8 + 0.5 = -0.3$ (mm)

Adjustment is completed.

(b) Repeat steps ① to ⑫.
If the dial gauge reading meets the standard of 0 ±0.7 mm in step ⑫, adjustment is completed.

17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE (F/T)

C. Optical Axis Adjustment of Binocular Unit

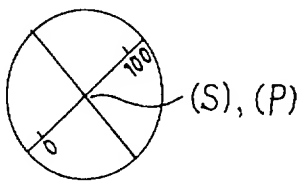


⑬ Set the tools on the microscope body as shown above.

- ○ Remember to draw out the 1X objective lens from the round dovetail adapter.
- ○ Return the sub-stage to the standard height position. -- Point Ⓢ shown in the figure above
- ○ The figure above shows the adjustment tools using the 30 mm dia. cross eyepiece J25221. However, the 23.2 mm dia. eyepiece having been used till now will do, as a matter of course.

★ Insert the eyepiece into the right sleeve.

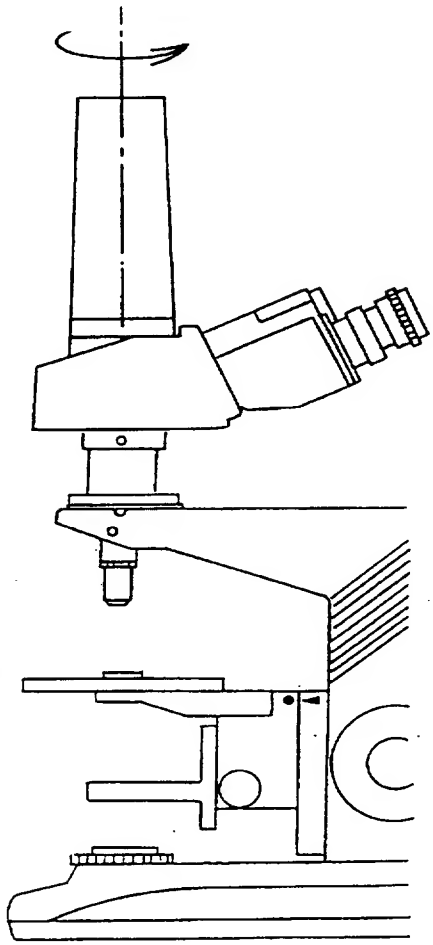
⑭ Move the stage and align the center of the grating specimen (P) with the cross center of the eyepiece (S).



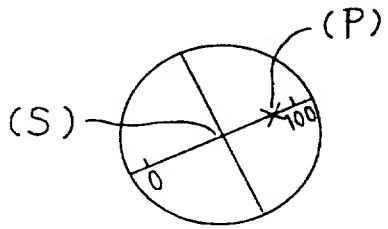
17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE (F/T)

⑮ Rotate the eyepiece tube in the round dovetail adapter by half turn (as shown on the right).

Check the shift of the grating specimen center (P) from the cross center of the eyepiece (S).



☞ Rotate the eyepiece in the sleeve and align the scale line with (P) as shown below.
By this, the shift can be measured easily.

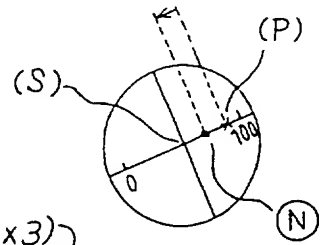


Standard value: 0.2 mm or less (Two divisions on the eyepiece scale)

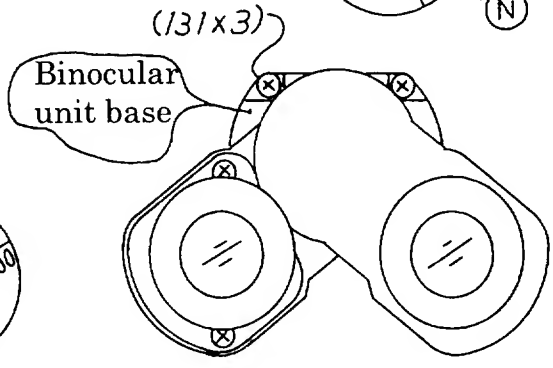
☞ If the shift is below the standard value, no adjustment is needed.

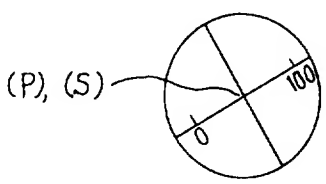
☞ If it exceeds the standard value, proceed to step ⑯.

⑯ Move the stage to move the grating specimen center (P) to the center (N) between (P) and (S).



⑰ Loosen the set screws (131 x 3) and move the binocular unit base to adjust the cross center of the eyepiece (S) to (P).

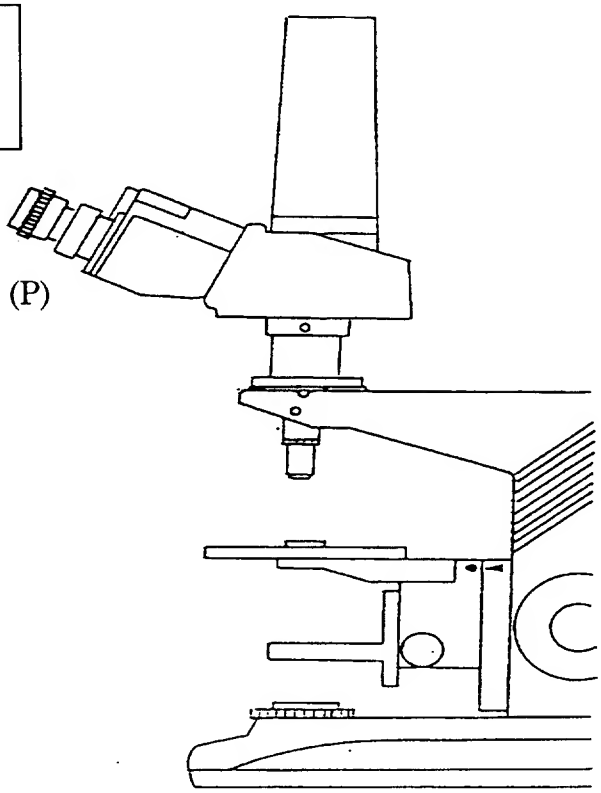




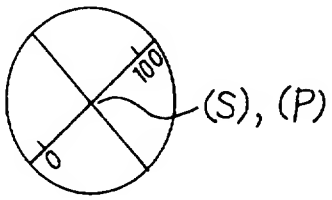
☞ Rotate the eyepiece tube in the round dovetail adapter by half turn, and check whether the shift of (P) from (S) meet the standard value shown in step ⑮.
Repeat steps ⑮ to ⑰.

17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE (F/T)

D. Optical Axis Adjustment of Photo Tube
(with respect to Right Eyepiece)



⑱ Move the stage with the cross eyepiece (J25221) inserted in the right sleeve to adjust the center of the grating specimen (P) to the cross center of the eyepiece (S) in succession to the procedure C.

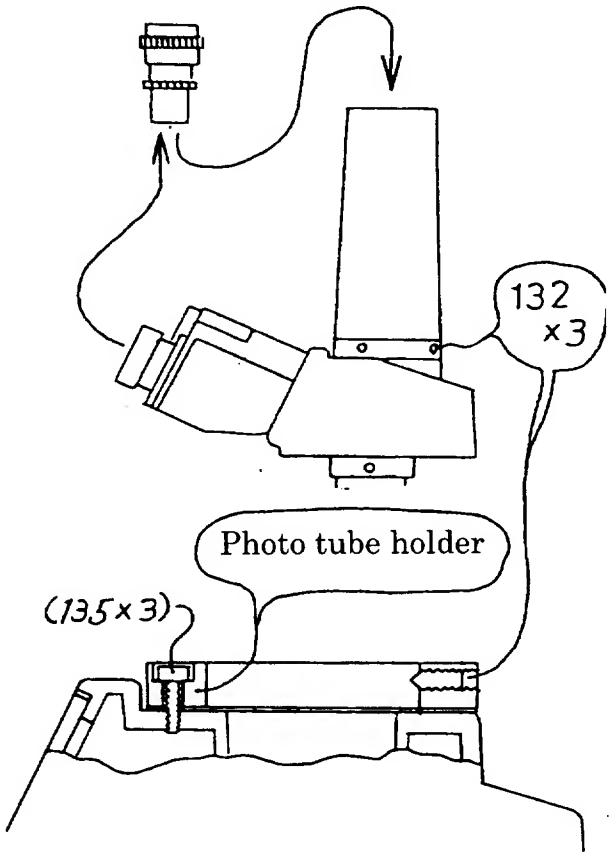


⑲ Remove the cross eyepiece from the right sleeve and insert it into the photo tube.

Check the shift of (P) from (S).

Standard value: 0.1 mm or less
(One division on the eyepiece scale)

If the shift does not meet the standard value, correct the shift as shown in (a) and (b) below.

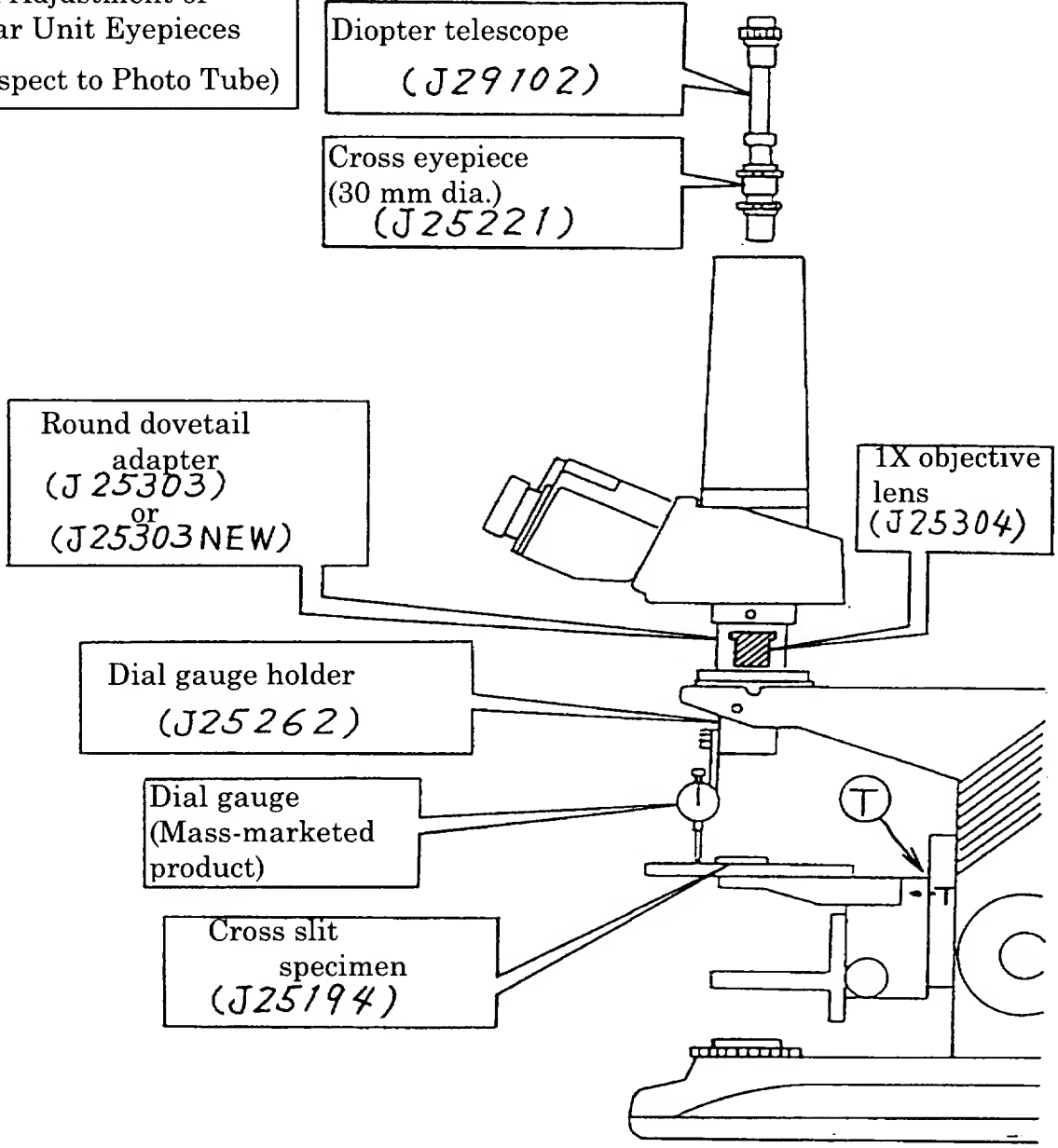


(a) Loosen the set screws (132 x 3) on the side, and remove the photo tube.

(b) Loosen the set screws (135 x 3) and move the photo tube holder.

17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE (F/T)

E. Parfocal Adjustment of Binocular Unit Eyepieces (with respect to Photo Tube)



⑳ Set the tools and dial gauge to the microscope body as shown above.

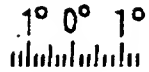
★ Adjust the sub-stage to the "T" mark (Ⓣ in the above figure).

○ Adjust the diopter scale of the diopter telescope to "0".

○ Do not set the cross slit specimen yet.

17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE (F/T)

㉑ Rotate the diopter ring of the diopter telescope to adjust the focus to the reticle of the diopter telescope.

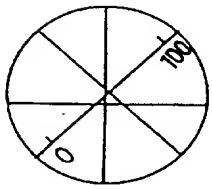


㉒ Rotate the diopter ring of the cross eyepiece to adjust the focus to the cross scale.

㉓ Set the cross slit specimen on the stage top surface.
Rotate the coarse focusing handle to adjust the focus to the cross slit.

★Stop rotating the handle at the point where the blue (or red) color around the slit is about to change into red (or blue).

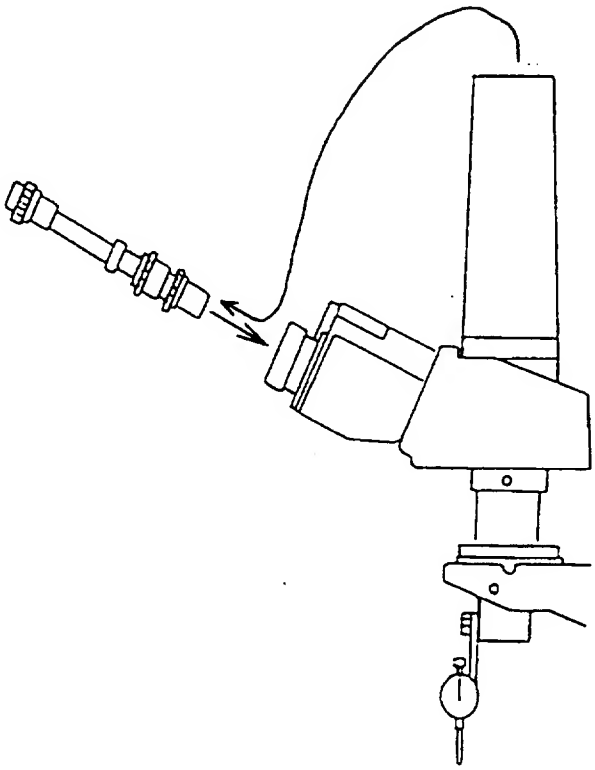
Remember the condition at the moment when the color changes sensuously.



★ Hereinafter, do not touch the diopter ring of either the diopter telescope or cross eyepiece.

㉔ Apply the top of the dial gauge probe to the stage surface.
Adjust the scale to "0".

㉕ Draw out the cross eyepiece together with the diopter telescope from the photo tube.
Insert them into the right eyepiece sleeve of the binocular unit.



17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE (F/T)

㉖ Rotate the coarse focusing handle to adjust the focus to the slit in the same manner as described in ㉓.

★ Stop rotating the handle at the point where the blue (or red) color is about to change into red (or blue).

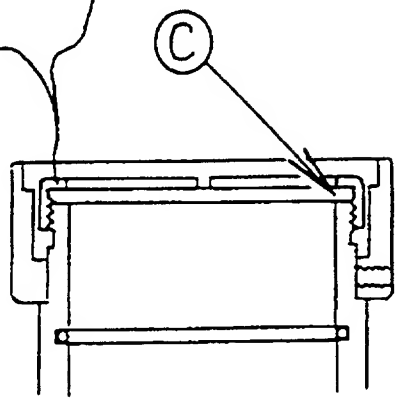
☞ No adjustment is needed if the scale of the dial gauge reads the standard value shown below:

Standard value: 0 ±0.06 mm

☞ If the dial gauge reads an off-standard value, rotate the adjust ring shown below.

Adhesive (#350) is applied to the threads.

Adjust ring



★ Apply alcohol to the gap indicated with the arrow Ⓒ with tweezers.
Make it penetrate into the threads to melt the adhesive.

○ When the dial gauge reads a positive value, rotate the adjust ring clockwise. When it reads a negative value, rotate the ring counterclockwise.

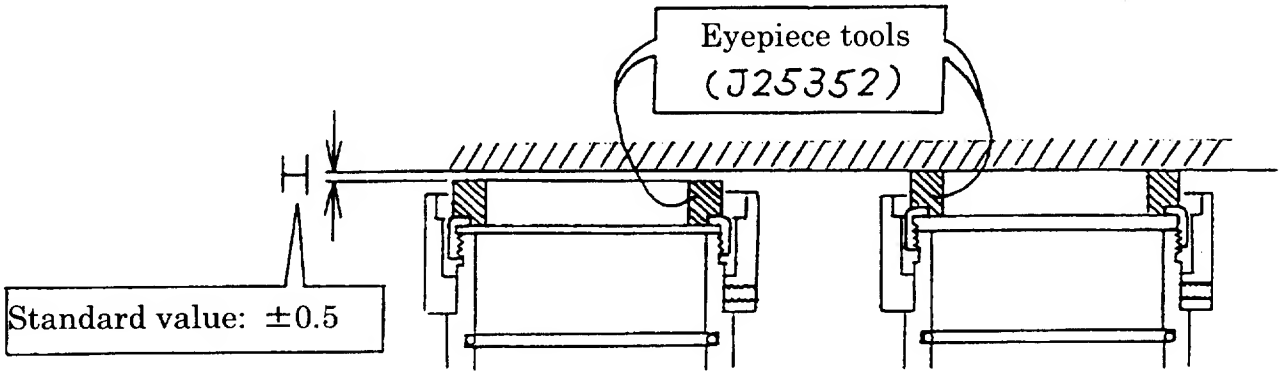
○ Standard rotation: 1/5 turn per 0.1 mm

㉗ Remove the eyepiece from the right sleeve and insert it into the left sleeve. Carry out the same adjustment as described in ㉖.

17. ADJUSTMENT OF TRINOCULAR EYEPIECE TUBE (F/T)

F. Height Difference Adjustment of Eyepiece Sleeves

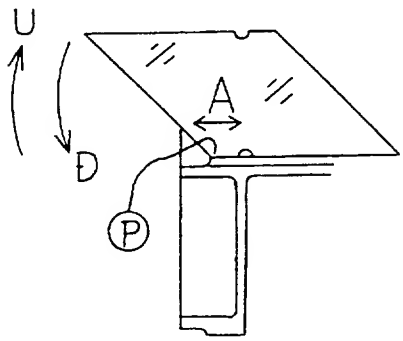
㉘ Insert the eyepiece tools (J25352) into the adjust ring as shown below.
Apply the straight edge to the tool top surface and check the height difference (H).



☞ If the value of H is not up to standard, detach the left cover, tilt the lozenge-shaped prism to change the optical path length, and adjust the height of the left adjust ring.

◎ If the left adjust ring is too low as shown above, tilt the lozenge-shaped prism in the direction of the arrow D as shown on the right.

If the left adjust ring is too high, tilt the prism in the direction of the arrow U.



★ Be careful not to shift the prism in the direction of the arrow A.

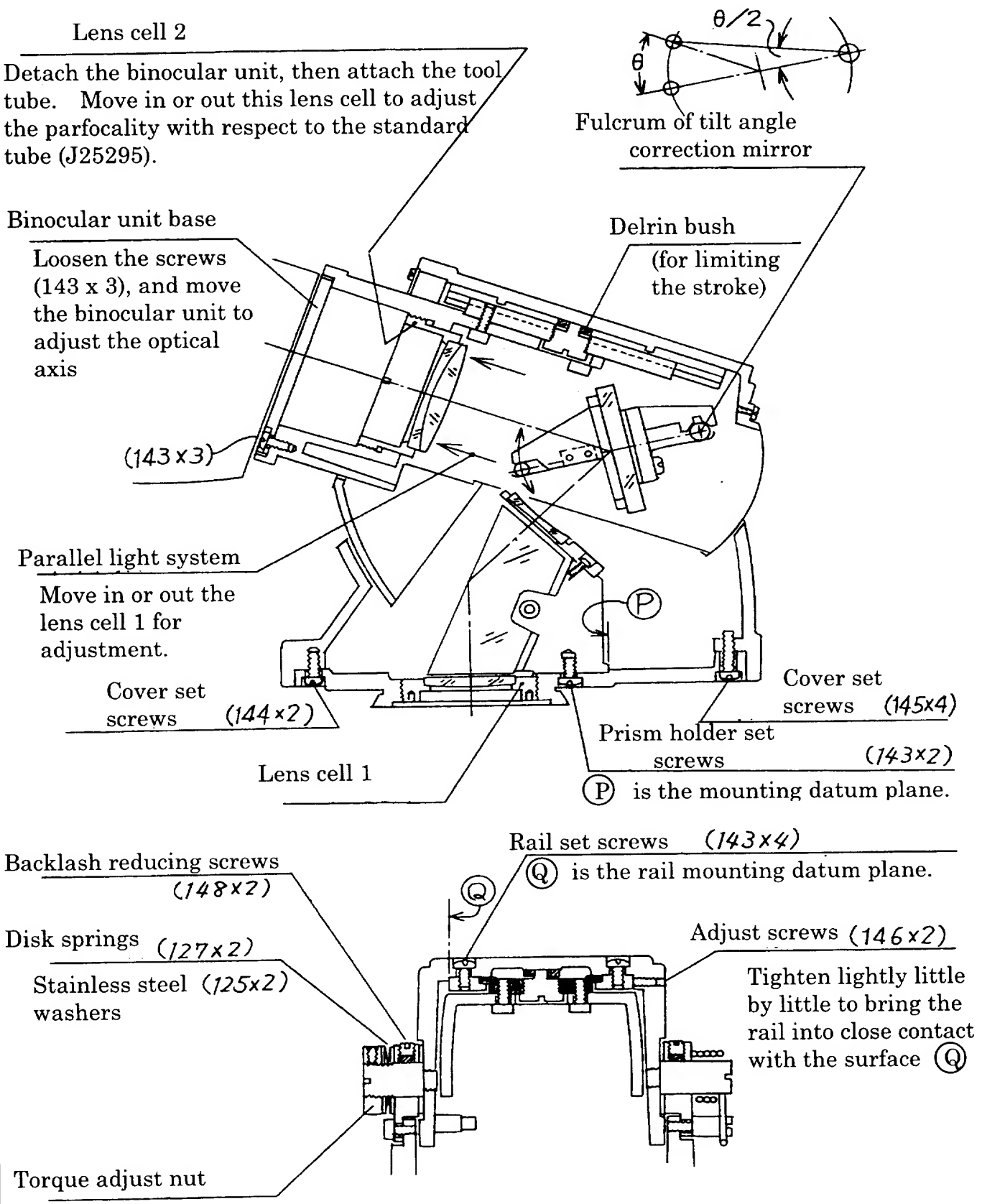
-- In order not to separate the edge of the prism from the rail end Ⓟ --

If the edge of the prism is separated from the rail end Ⓟ, it is necessary to adjust the optical axis of the left eyepiece as shown in Section 15-3 (on page 39).

☞ Once the prism is tilted, check whether the parfocality of the left eyepiece meets the standard again.

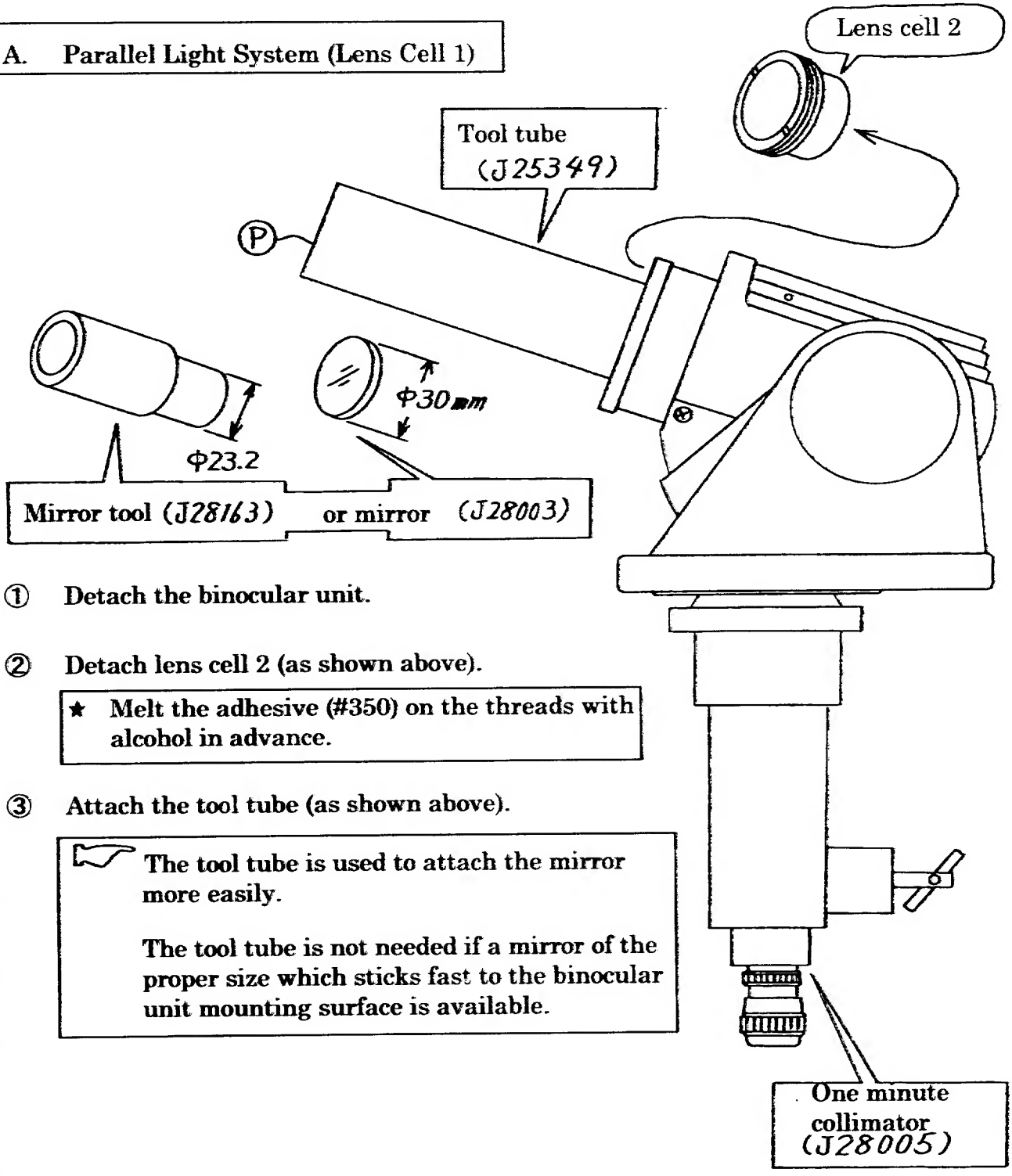
18. ADJUSTMENT OF ERGONOMICS EYEPIECE TUBE (EX)

[CROSS SECTIONAL VIEW]


Lens cell 2
Detach the binocular unit, then attach the tool tube. Move in or out this lens cell to adjust the parfocality with respect to the standard tube (J25295).
θ/2
θ
Fulcrum of tilt angle correction mirror
Binocular unit base
Loosen the screws (143 x 3), and move the binocular unit to adjust the optical axis
Delrin bush (for limiting the stroke)
(143×3)
Parallel light system
Move in or out the lens cell 1 for adjustment.
Cover set screws (144×2)
Cover set screws (145×4)
Prism holder set screws (143×2)
Lens cell 1
(P) is the mounting datum plane.
Rail set screws (143×4)
Backlash reducing screws (148×2)
(Q) is the rail mounting datum plane.
Disk springs (127×2)
Adjust screws (146×2)
Stainless steel (125×2) washers
Tighten lightly little by little to bring the rail into close contact with the surface (Q).
Torque adjust nut

18. ADJUSTMENT OF ERGONOMICS EYEPIECE TUBE (EX)

A. Parallel Light System (Lens Cell 1)



① Detach the binocular unit.

② Detach lens cell 2 (as shown above).

★ Melt the adhesive (#350) on the threads with alcohol in advance.

③ Attach the tool tube (as shown above).

The tool tube is used to attach the mirror more easily.

The tool tube is not needed if a mirror of the proper size which sticks fast to the binocular unit mounting surface is available.

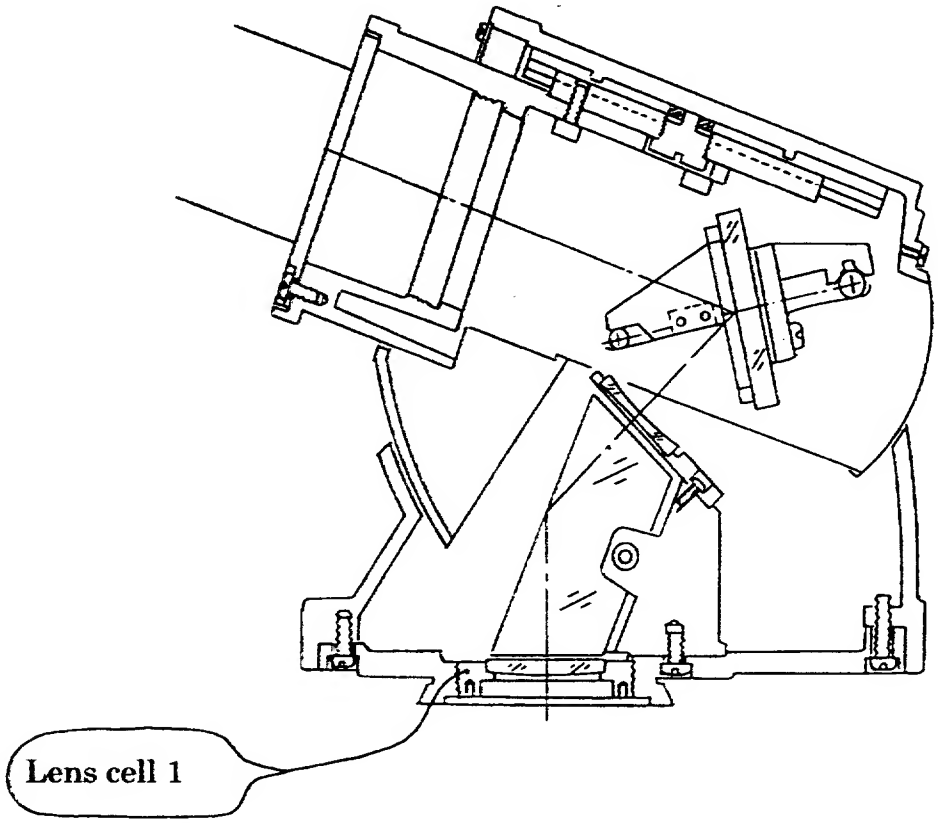
④ Insert the mirror tool into the tool tube.

Or, you may apply the mirror (J28003) to the top surface of the tool tube (Ⓟ in the figure above) and fix it with adhesive tape.

18. ADJUSTMENT OF ERGONOMICS EYEPIECE TUBE (EX)

⑤ **Press the one minute collimator against the end face of the round dovetail. Check if the scale image reflected by the mirror is focused on the stationary scale surface.**

☞ **If the scale image is out of focus, draw out or insert lens cell 1 to adjust the focus.**



★ **Melt the adhesive (#350) on the threads with alcohol, then draw out or insert lens cell 1.**

★ **After completion of adjustment, apply adhesive.**

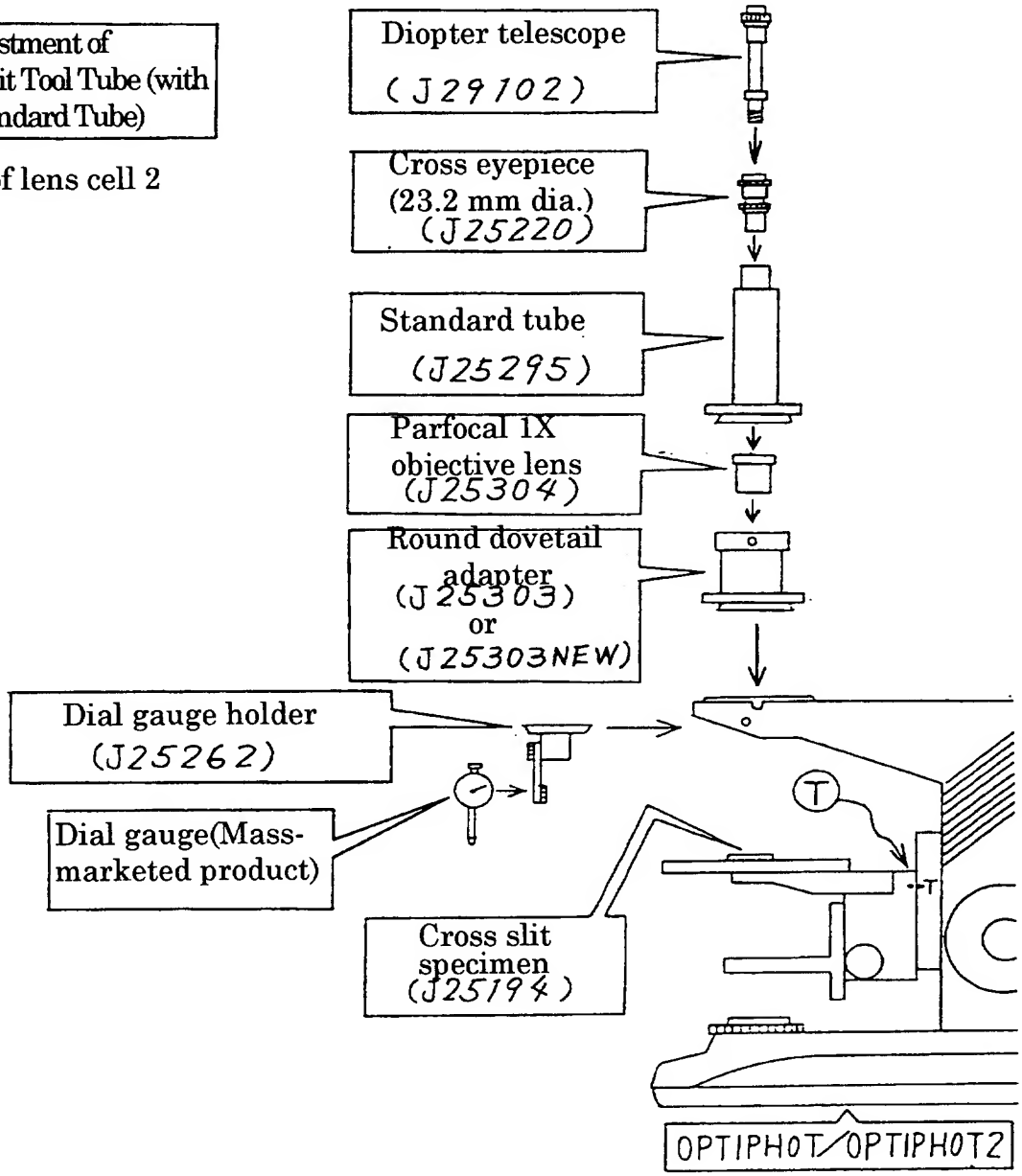
⑥ **Screw lens cell 2 into the previous position.**

★ **Do not apply adhesive until the next adjustment procedure B is completed.**

18. ADJUSTMENT OF ERGONOMICS EYEPIECE TUBE (EX)

B. Parfocal Adjustment of Binocular Unit Tool Tube (with respect to Standard Tube)

Adjustment of lens cell 2



⑦ Set the tools and dial gauge to the microscope body as shown above.

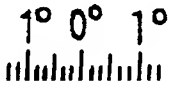
★ Adjust the sub-stage to the "T" mark (Ⓣ in the above figure).

○ Adjust the diopter scale of the diopter telescope to "0".

○ Do not set the cross slit specimen yet.

18. ADJUSTMENT OF ERGONOMICS EYEPIECE TUBE (EX)

⑧ Rotate the diopter ring of the diopter telescope to adjust the focus to the reticle of the diopter telescope.

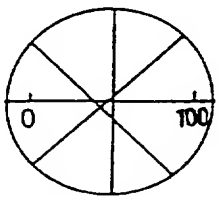


⑨ Rotate the diopter ring of the cross eyepiece to adjust the focus to the cross scale.

⑩ Set the cross slit specimen on the stage top surface.
Rotate the coarse focusing handle to adjust the focus to the cross slit.

★ Stop rotating the handle at the point where the blue (or red) color around the slit is about to change into red (or blue).

☞ Remember the condition at the moment when the color changes sensuously.



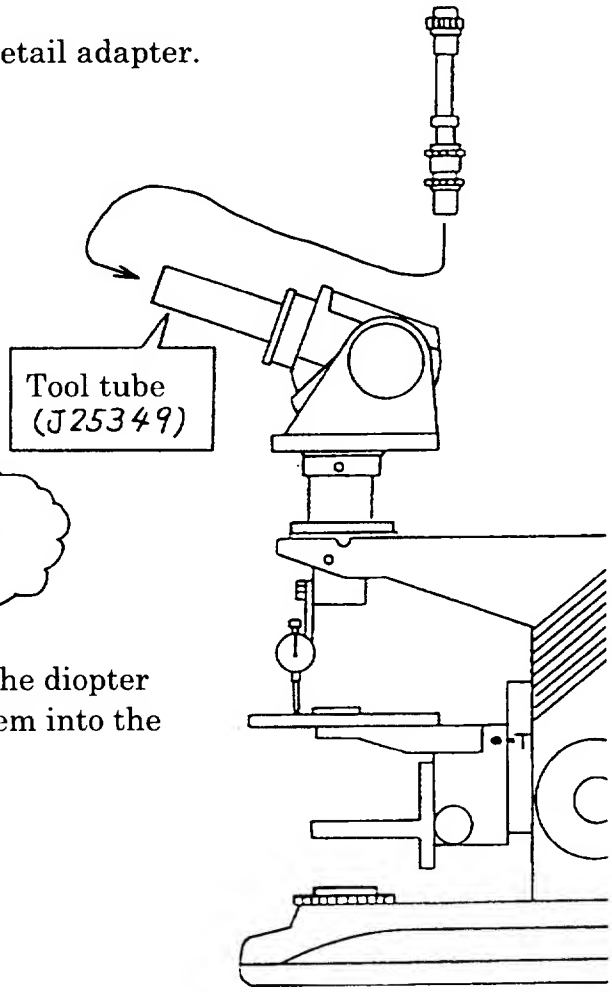
★ Hereinafter, do not touch the diopter ring of either the diopter telescope or cross eyepiece.

⑪ Apply the top of the dial gauge probe to the stage surface.
Adjust the scale to "0".

⑫ Detach the standard tube from the round dovetail adapter.
Attach the eyepiece tube instead of it.

☞ Detach the binocular unit.
Attach the tool tube.

★ Attach the tool tube so that three screws are located at the centers of three holes in the tool tube.



⑬ Draw out the cross eyepiece together with the diopter telescope from the standard tube. Insert them into the tool tube.

18. ADJUSTMENT OF ERGONOMICS EYEPIECE TUBE (EX)

⑭ Rotate the coarse focusing handle to adjust the focus to the slit in the same manner as described in ⑩.

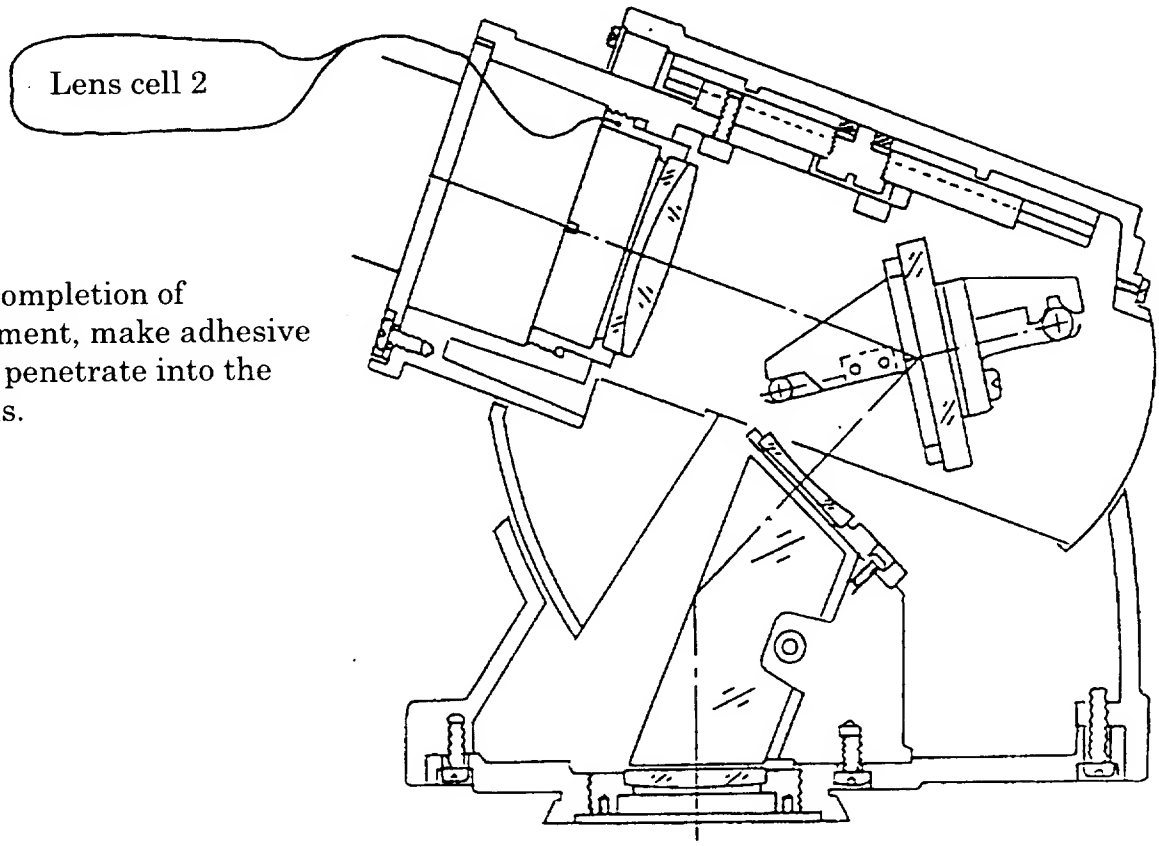
★ Stop rotating the handle at the point where the blue (or red) color is about to change into red (or blue).

☞ No adjustment is needed if the scale of the dial gauge reads a value of 0 ±0.5 mm, though there is no particular standard value.

★ If the dial gauge value is too greater or smaller than zero, parfocal adjustment may not be achieved within the movable range of the adjust ring in the "parfocal adjustment of binocular unit eyepiece" described below (on page 77).

☞ Rotate lens cell 2 to adjust.

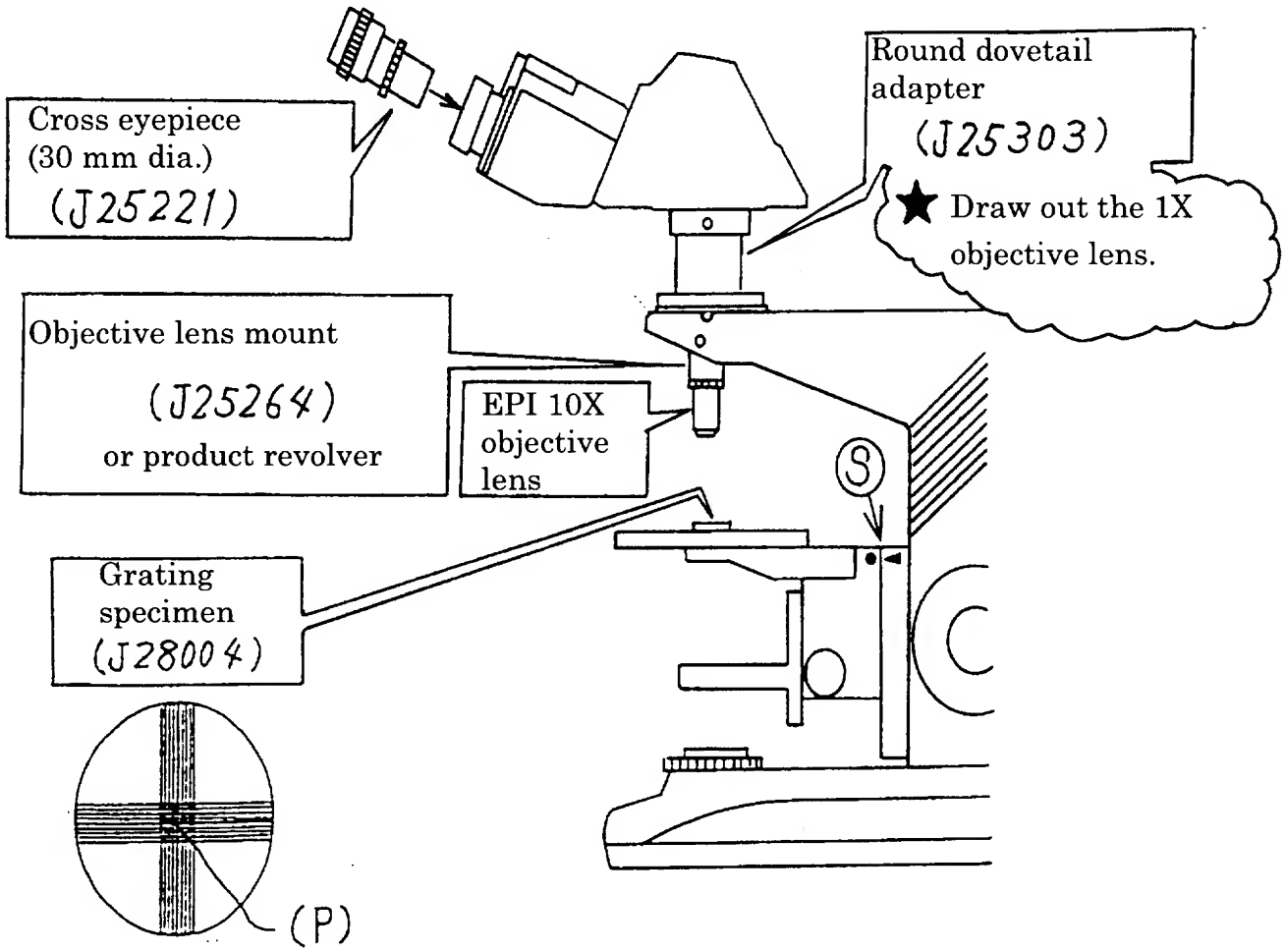
- When the dial gauge reads a positive value, rotate lens cell 2 counterclockwise. When it reads a negative value, rotate lens cell 2 clockwise.
- Standard rotation: 1/5 turn per 0.1 mm



★ After completion of adjustment, make adhesive (#350) penetrate into the threads.

18. ADJUSTMENT OF ERGONOMICS EYEPIECE TUBE (EX)

C. Optical Axis Adjustment of Binocular Unit

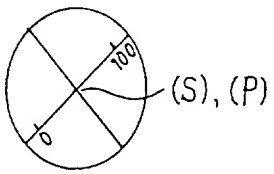


⑮ Set the tools on the microscope body as shown above.

- ○ Remember to draw out the 1X objective lens from the round dovetail adapter.
- ○ Return the sub-stage to the standard height position.
  -- Point Ⓢ shown in the figure above
- ○ The figure above shows the adjustment tools using the 30 mm dia. cross eyepiece J25221. However, the 23.2 mm dia. eyepiece having been used till now will do, as a matter of course.

★Insert the eyepiece into the right sleeve.

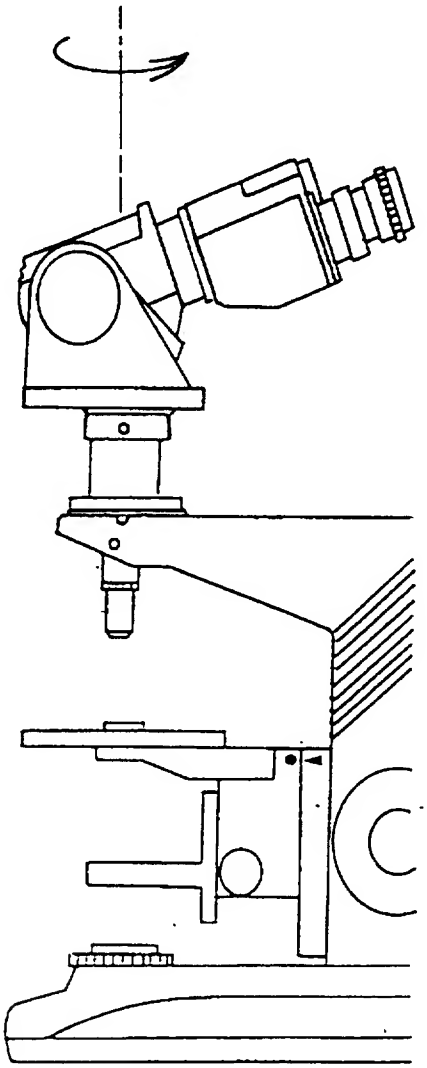
⑯ Move the stage and adjust the center of the grating specimen (P) to the cross center of the eyepiece (S).



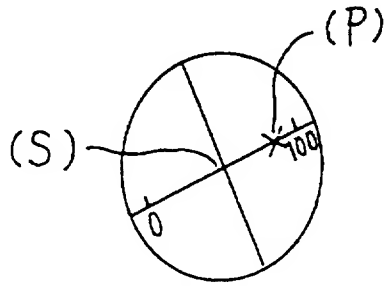
18. ADJUSTMENT OF ERGONOMICS EYEPIECE TUBE (EX)

⑰ Rotate the eyepiece tube in the round dovetail adapter by half turn (as shown on the right).

Check the shift of the grating specimen center (P) from the cross center of the eyepiece (S).



☞ Rotate the eyepiece in the sleeve and align the scale line with (P) as shown below. By this, the shift can be measured easily.

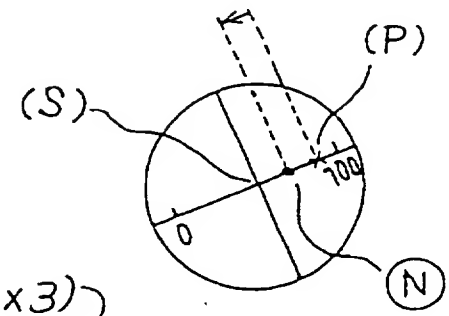


Standard value: 0.2 mm or less

(Two divisions on the eyepiece scale)

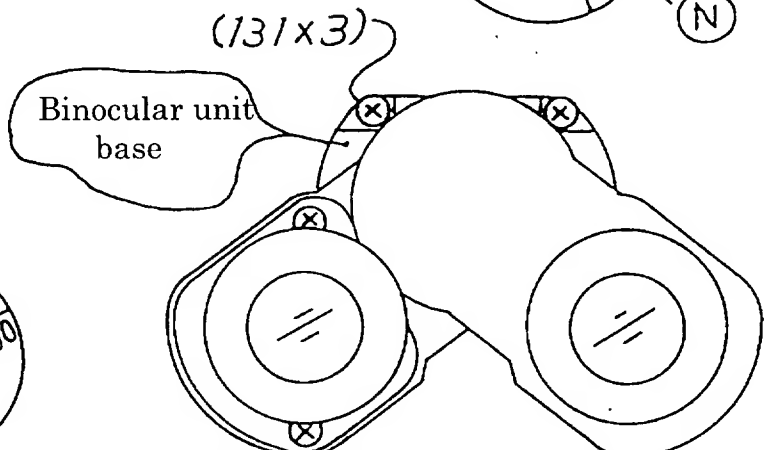
☞ If the shift is below the standard value, no adjustment is needed.

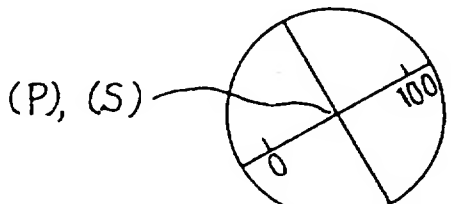
☞ If it exceeds the standard value, proceed to step ⑱.



⑱ Move the stage to move the grating specimen center (P) to the center (N) between (P) and (S).

⑲ Loosen the set screws (131 x 3) and move the binocular unit base to adjust the cross center of the eyepiece (S) to the center of the grating specimen (P).





☞ Rotate the eyepiece tube in the round dovetail adapter by half turn, and check whether the shift of (P) from (S) meet the standard value shown in step ⑰.Repeat steps ⑰ to ⑲.

18. ADJUSTMENT OF ERGONOMICS EYEPIECE TUBE (EX)

D. Parfocal Adjustment of Binocular Unit Eyepieces (with respect to Standard Tube)

The adjustment procedures are quite the same as described in steps ① to ⑨ in Section 16 "Adjustment of Binocular Eyepiece Tube (B)" (on pages48 to 50).

E. Height Difference Adjustment of Eyepiece Sleeves

The adjustment procedure is quite the same as described in step ⑩ in Section 16 "Adjustment of Binocular Eyepiece Tube (B)" (on page 51).